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EXPOSURE ASSESSMENT TECHNICAL MEMORANDUM

REMEDIAL INVESTIGATION (RI)/FEASIBILITY STUDY (FS)
OLIN CHEMICALS
MCINTOSH PLANT

Prepared for
Olin Corporation
Charleston, Tennessee

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Olin Chemical Company is conducting a Remedial Investigation/Feasibility Study (RI/FS) at their McIntosh, Alabama facility. As part of the RI/FS, a baseline human health risk assessment is being performed. The Exposure Assessment Technical Memorandum was prepared in conformance with current EPA guidance (Risk Assessment Guidance for Superfund, Volume I, EPA 1989). The objective of the exposure assessment is to identify the populations that may be most exposed to site-related chemicals, the pathways by which exposures may occur, and the magnitude, frequency, and duration of the exposures. The results of the exposure assessment are pathway-specific chemical intakes of identified potential chemicals of concern.

The exposure assessment addressed potential exposure pathways from both current and future exposure scenarios. The key human receptor populations identified included offsite adult and children residents and future remediation workers. Identified potential media of concern included groundwater, surface water, sediments and fish.

Significant conclusions of the exposure assessment were:

- In general, pathways that showed the lowest chemical intakes (i.e., approximately 1.0×10^{-6} mg/kg/day or less) of site contaminants included dermal exposures to surface water, groundwater, and sediment, and ingestion of sediment and surface water.

- Ingestion of groundwater and fish were associated with the highest chemical intakes at the site.

- Daily chemical intakes by residential receptors of contaminants of potential concern through the ingestion of fish were associated with the highest exposure to chemicals capable of driving the human health risks/hazards at the site; most notably 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, hexachlorobenzene and mercury. The DDT compounds are not related to the Olin McIntosh plant.

1.0
INTRODUCTION

The objective of the exposure assessment is to identify the human populations that may be most exposed to site-related chemicals, the pathways by which exposures may occur, and the magnitude, frequency, and duration of the exposures. Discussion of ecological concerns will be addressed in the Environmental Evaluation Technical Memorandum to be submitted at a later date. The exposure assessment focuses on the chemicals of potential concern at the site. The chemicals of potential concern for the Olin Chemicals McIntosh plant were presented in the Hazardous Substance Indicator Parameter Technical Memorandum (HSIPTM) submitted by Olin Chemicals to the U. S. Environmental Protection Agency (EPA) on December 19, 1991. A revised list of media-specific chemicals of potential concern are presented in Table 1. The initial list was developed and submitted to EPA prior to completion of data validation. The list presented in Table 1 is based on validated data and incorporates EPA comments to the HSIPTM. This list includes all Class A carcinogens that were reported in the chemical analysis and has been expanded to include fish and domestic well media. Lead is not addressed quantitatively in the exposure assessment but contribution of lead to overall potential risk/hazard will be assessed quantitatively using the biokinetic uptake model (EPA) in the baseline risk assessment. The rationale used to select the chemicals of concern was also presented in the previous technical memorandum along with documentation. The exposure scenario evaluated in this exposure assessment includes analysis of the exposure to the constituents of concern under baseline (i.e., current use and no action conditions) and addresses hypothetical future land use options. **The results of the exposure assessment are pathway-specific chemical intakes of identified potential chemicals of concern.**

2.0 SITE DESCRIPTION

2.1 PHYSICAL SETTING

The Olin Chemicals McIntosh plant is located approximately 1 mile east-southeast of the town of McIntosh, in Washington County, Alabama. A site location map is presented in Figure 1. The property is bounded on the east by the Tombigbee River, on the west by land (not owned by Olin) west of U. S. Highway 43, on the north by the Ciba-Geigy Corporation plant site and on the south by River Road.

The regional setting for the site is the East Gulf Coastal Plain Physiographic Province. Specifically, the 1,500 acres that comprise the Olin property are within the Southern Pine Hills District.

The Olin McIntosh plant is an active chemical production facility located on land owned by Olin. The main plant and associated Olin properties cover approximately 1,500 acres, with active plant production areas occupying approximately 60 acres.

A history of site operations is provided to present relative information related to potential site contamination activities. Olin operated a mercury cell chlorine-caustic soda plant on a portion of the site from 1952 through December 1982. In 1954, Olin began operating the organics plant on an adjacent portion of the site. The organics plant originally produced monochlorobenzene. In 1956 a pentachloronitrobenzene (PCNB) plant was completed and PCNB production began. The organics plant was expanded in 1973 to produce trichloroacetonitrile (TCAN) and 5-ethoxy-3-trichloromethyl-1,2,4-thiadiazole (Terrazole®). The PCNB, TCAN and Terrazole® manufacturing areas were collectively referred to as the Crop Protection Chemicals (CPC) plant. In 1978, Olin constructed a diaphragm cell caustic soda/chlorine plant which is still in operation. The CPC plant and mercury cell plant were shut down in late 1982.

Current active facilities at the plant include: a diaphragm cell chlorine and caustic production process area; a caustic concentration process area; a caustic plant salt process area; a hydrazine blending process area, shipping and transport facilities; process water storage, transport and treatment facilities; and support and office areas.

The Olin McIntosh plant currently monitors and reports on several facilities permitted by the EPA and the Alabama Department of Environmental Management (ADEM). These permits include 17 air permits, one NPDES with 5 outfalls, one RCRA post-closure permit (including several SWMUs and a groundwater corrective action program), one Class III injection well and one Class V Underground Injection Control (UIC) well.

In September 1984, Olin's McIntosh plant site was placed on the National Priority List of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or "Superfund." Groundwater contamination at the site has been established based on the results of various investigations. Mercury and chloroform are the principal contaminants identified at the site. Mercury contamination is likely associated with the operation of the mercury cell chlor-alkali plant during the period 1952 to 1982. The chloroform contamination is likely to be associated with the operation of the CPC plant from 1954 to 1982. Investigations have also indicated contamination in a 65-acre natural basin, herein referred to as the "basin," located on the Olin property east of the active plant facilities. This basin received plant wastewater discharge from 1952 to 1974.

Two operable units have been designated for the facility. Operable Unit 1 (OU-1) is the plant area (all of the Olin property except the area defined as OU-2). Operable Unit 2 (OU-2) is the basin, including the wetlands within the Olin property line and the wastewater ditch leading to the basin. Figure 2 is a facility layout map delineating the boundaries of the two operable units.

2.1.1 Climate

The following information is based on data from the climatological station in Mobile (approximately 50 miles south of McIntosh).

The McIntosh plant site is typically humid year-round with a subtropical climate. The average annual temperature is about 68° F, with July having the highest average temperature of 82° F and January having the lowest average temperature of 50° F.

South Alabama's annual rainfall is among the highest in the United States, averaging about 64 inches. The precipitation is relatively evenly distributed over the year, although there is a small peak in July during the thunderstorm season, when monthly rainfall averages 7.6 inches. The dry season runs from October through November, when the monthly average is 3.5 inches. Thunderstorms, the predominant mode of precipitation, occur on an average of 80 days a year, more frequently in summer than other seasons.

Wind flow patters are variable throughout the year, but there are some broad seasonal patterns. From September through February, winds are dominantly in a northerly direction, with dominant southerly and southeasterly winds the remainder of the year.

2.1.2 Surface Features and Drainage

Surface features and drainage are described for each operable unit. The information provided in this section is generally from the site reconnaissance and review of existing information that was conducted as part of the site characterization activities. This is important towards addressing potential migration of site contaminants and subsequent potential exposure to offsite human receptors. Information from subsurface features and drainage patterns are important towards determining complete exposure pathways.

2.1.2.1 Operable Unit 1

The active production areas of the plant are relatively flat with little topographic variation. The land surface is generally at elevations of approximately 40 to 50 feet above mean sea level (msl). A north-south oriented topographic high of greater than 50 feet msl exists from the northern to the southern extent of Olin's property and is located west of the production facility and Industrial Road, but east of the brine well field. This topographic high creates a drainage divide which defines the two major surface water drainage pathways within the Olin property. The most distinctive topographic feature is a steep bluff located approximately 4,000 feet east of the main plant area. This bluff defines the edge of the low-lying floodplain area, which is about 25 feet lower in elevation than the upland areas immediately to the west.

West of this drainage divide, the majority of surface runoff drains west to low lying areas in the vicinity of the brine well field and continues westward across Highway 43, discharging into Bilbo Creek. Additional surface water runoff to the southwest along Industrial Road also discharges to Bilbo Creek. Bilbo Creek, a tributary of the Tombigbee River, exists at an elevation of less than 20 feet msl in this area.

The majority of surface runoff from the study area (OU-1) flows east and southeast to the Olin wastewater ditch which discharge into the Tombigbee River farther to the southeast. The elevation in this drainage area varies from about 40 feet msl on the plant site to less than 10 feet msl in the wastewater ditch at the basin.

Drainage from west of Industrial Road including the treated effluent from corrective action wells CA-1 and CA-2 flows eastward beneath Industrial Road into the main plant area. From here, flow continues eastward to an NPDES-permitted discharge at the beginning of the wastewater ditch located at the southeast corner of the facility. Surface runoff from the active production areas of the plant drains to the southeast through a system of culverts and ditches to the wastewater ditch. Drainage from the former CPC plant and engineering training facility areas flows north and eastward to the wastewater ditch. Surface runoff from the active ash pond area and properties to the east drain eastward and northward into the wastewater ditch. Runoff from the northern portions of the site, including the parking areas, flows eastward to an area ponded by beaver activity which subsequently drains southeastward into the wastewater ditch and Tombigbee River.

2.1.2.2 Operable Unit 2

Drainage

Prior to the construction of the Olin facility, the wastewater ditch was a natural drainage feature that carried runoff from the upland areas where the plant is presently located. This runoff naturally discharged into the basin. The Olin plant was constructed in 1952. Subsequently from 1952 to 1974 wastewater from the facility and runoff from the facility discharged into the basin.

In 1974 Olin re-routed the wastewater ditch to the Tombigbee River bypassing the basin. Also constructed at this time was a sheet pile weir located at the southern outlet of the basin to the river. This weir was constructed to control the water level in the basin and keep the wastewater stream from discharging into the basin during periods of low river stages. Another drainage pathway into OU-2 carries runoff from the very northern extent of the Olin property near the boundary with Ciba-Geigy. There have been no plant operations within this drainage area. Runoff from this area is to the ponded areas north of the basin which subsequently discharge into the basin at the northern boundary of the basin.

River Stage Data

The basin and surrounding wetlands lay within the floodplain of the Tombigbee River. During seasonal high water levels (averaging 4 to 6 months per year), the basin and wetland areas are inundated, becoming contiguous with the adjacent Tombigbee River. Historical river stage data was obtained from the U. S. Corps of Engineers, Coffeeville Station (located approximately 42 miles north of McIntosh). There is a seasonal rise in water elevations beginning as early as November and lasting to as late as August of the following year. Over the previous five high-water events, river stages have risen an average of 30 feet. Although these data were obtained from 42 miles north of McIntosh, it is believed that river stages in the vicinity of the site are similar.

2.1.3 Groundwater Flow

There are two aquifers beneath the site, the Alluvial Aquifer and the Miocene Aquifer. The Alluvial Aquifer is generally unconfined with a thickness of about 55 and 80 feet. The Alluvial Aquifer and the Miocene Aquifer are separated by the Upper Miocene Confining Unit, which is interpreted to be laterally continuous at the site and approximately 80 to 100 feet thick. The underlying Miocene Aquifer is the major source of drinking water in the area.

A potentiometric map showing groundwater flow patterns in the Alluvial Aquifer is presented in Figure 3. The potentiometric data (September 1991) shows groundwater entering the site from the north. Recharge is believed to be from direct infiltration of groundwater where the Alluvial Aquifer outcrops to the north of the Olin facility. Groundwater entering the site from the north is divided into east and west components by a hydraulic high oriented north-south through the center of the plant site. Flow in the eastern half is to the south and southeast discharging to the basin in the northern portion of the site. Farther south, flow continues in a southeasterly direction toward corrective action wells CA-3, CA-4, and CA-5, where groundwater pumping creates radial flow to the wells. South of the facility, flow appears to discharge eastward to the Tombigbee River. On the western side of this hydraulic high, flow is south and southwest toward the groundwater recovery area created by corrective action wells CA-1 and CA-2. A hydraulic mound believed to be due to ponded water is evident in the brine field area.

Extraction of groundwater from the five corrective action wells has caused localized depressions in the potentiometric surface beneath the site. The potentiometric data indicate that Olin's Corrective Action Program is effective at recovering groundwater migrating from any known past or current sources.

2.1.4 Natural Resources

There are only 60 acres out of 1,500 acres owned by Olin that have active chemical production facilities. The rest of the property beyond the active chemical facility is heavily forested with approximately 65 acres consisting of a natural basin and wetlands area. The natural basin drains into and is adjacent to the Tombigbee River.

This undeveloped area and natural basin are a natural habitat for wildlife, terrestrial and aquatic species. Further discussion on ecological concerns will be addressed in the Environmental Evaluation Technical Memorandum to be submitted at a later date.

2.2 SITE DEMOGRAPHICS

This section describes land use and the potential populations that might be exposed to chemicals at or potentially released from the site. The purposes of this section are 1) to identify potential human receptor populations and 2) to provide a basis for identifying exposure pathways to be further detailed in the Exposure Assessment.

For purposes of identifying populations and land uses that would experience the greatest potential impact from groundwater, surface water, sediment and fish/game contamination, an area encompassed by a 3-mile distance in all directions from the Olin McIntosh plant was evaluated. A comprehensive land use and demographic analysis of the site area was conducted within this 3-mile radius by consulting geographers Dr. Victorio Rivizzigno and Dr. Eugene Wilson, professors from the University of South Alabama. The Land Use, Demographic Analysis and Domestic Well Survey is presented in Appendix A.

The land use section of the analysis provided information on the major land uses within a 3-mile radius of the Olin facility and included the location of domestic water wells, their status (active or closed), description of their condition, depth, diameter, construction materials, how water was used, identification of primary and secondary sources of drinking water, and a notation of fishing habits of the residents in this area.

The demographic section of the analysis provided a description of the population in the study area, well-water user populations, and the population of Washington County, where the Olin facility is located.

Land use in the study area was recorded during onsite or ground observations, personal interviews, and through the use of aerial photographs and topographic maps. Information about domestic water-wells and fishing habits was obtained through personal interviews during a door to door survey. Attempts were made to interview every household in the study area to obtain the necessary domestic water-well information. When the householder was not available, neighbors were contacted to provide the information needed. Several visits were made to complete the survey.

Domestic water-well questionnaires were filled out for the houses where water wells were identified as either active, inactive, or closed up. A total of 122 domestic wells were identified. Forty-three wells were identified as active drinking water wells. The 43 wells constitute a population of about 3 percent of area residents that drink well water within the 3-mile radius of Olin. No questionnaires were filled out for those houses that did not have domestic water-wells. These homes were solely serviced by the town water system.

Data for the demographic analysis were collected from historical records, a private consulting firm, and personal interviews. Demographic and economic data for Washington County were obtained from federal and state government publications, and from interviews with a state government statistician.

Some of the key conclusions from the demographic analysis in regard to potential exposure were the discussions on resident drinking water supplies and fishing practices. Most houses in the 3-mile radius of the site are connected to the town water system and some families share water from the town system with their neighbors. Since only about 3 percent of the area residents drink well water, the magnitude of exposure via ingestion of well water is low. The exposure of area residents to potential contaminants in groundwater will be addressed in the exposure assessment.

The relative contribution of the basin to the total exposure in regard to fishing activities was addressed in the demographic analysis. For instance, the demographic analysis showed that the most popular places to fish are the Tombigbee River and Bilbo Creek, not the basin. This is paramount towards determining if a complete exposure pathway exists for ingestion of contaminated basin fish. No resident specifically identified the basin as an area where they fished. However, one cannot dismiss the likelihood of false responses on the questionnaire, particularly since trespassers are prohibited in the basin area. Therefore, consumption of basin fish by area residents was considered a viable exposure pathway in this exposure assessment. However, the contribution of contaminated fish from the basin to overall fish consumption by area residents is certainly less than 100 percent. In fact, estimates of "contaminated" fish consumption by area residents assuming ingestion from sources including the Tombigbee River is approximately 20 percent for reasonable maximum exposures (i.e., upper bound or 90th percentile) and 10 percent under average exposure situations. Fish ingestion rates by area residents are discussed in detail in Section 6.2. Although a complete consumption survey using published guidelines such as the Consumption Survey for Fish and Shellfish (EPA 822/R-92-001, February 1992) was not used, the information provided by the demographic analysis in regard to fishing activities is applicable to this exposure assessment.

In general, the major conclusions of the demographic survey in regard to the exposure assessment are:

- Only about 3 percent of the human population within a 3-mile radius of the plant use well water as a drinking water supply

- Most of the fish consumed by local residents comes from areas besides the basin

The site characterization sampling activities which were conducted from July through November 1991 included sampling and chemical analysis of onsite groundwater and offsite groundwater (domestic wells) in OU-1, and sampling and chemical analysis of sediment, surface water and fish in OU-2. Additional sampling is planned at this time in both operable units.

OU-1, Onsite Groundwater Sampling

Thirty-three selected onsite wells (monitor, production, and corrective action) were sampled for the RI/FS. The selected wells were sampled and analyzed for the following constituents as specified in the EPA Contract Laboratory Program (CLP): Target Compound List (TCL) Volatile Organics; TCL Semivolatile Organics; TCL Pesticides/PCBs; Target Analyte List (TAL) mercury (total and dissolved); a subset of the Target Analyte List that includes the following thirteen metals on the Priority Pollutant List and cyanide:

Arsenic	Silver
Cadmium	Antimony
Chromium	Beryllium
Lead	Copper
Mercury	Zinc
Nickel	Thallium
Selenium	Cyanide

The groundwater samples were also analyzed in the laboratory for chloride. Field analyses included pH, specific conductance and temperature.

OU-1, Offsite Groundwater Sampling

Forty-three domestic wells within a 3-mile radius of the facility were identified as drinking water wells. Thirty-four of these wells were determined to be sampleable. The 34 wells were sampled in November 1991 as part of the site characterization activities. The samples were analyzed for total mercury, TCL Volatile Organics, total organic carbon (TOC), total dissolved solids (TDS), total suspended solids (TSS), and chloride. The TCL Volatile Organics were selected as the organic analytes based on the results of the onsite sampling.

OU-2, Sediment Sampling

Core sediment samples were collected at the three sample locations during the Phase I sediment sampling. Two cores were obtained from the basin and one core was obtained from the former wastewater ditch. Each core was completed to an approximate depth of 5 feet and samples were collected at approximate 1-foot intervals. In addition to the core sampling, grab surface samples were collected on a grid established at approximate 200 feet spacing across the basin. The wastewater ditch, discharge ditch, the former flow path from the wastewater ditch to the basin, and the current flow path from the wastewater ditch to the discharge ditch were sampled approximately every 200 feet along the centerline. These were also grab-type samples. All samples were split and analyzed for TAL mercury by CLP procedures. In addition to the mercury analyses, selected split core samples and grid samples were analyzed for soluble mercury, pH, Total Organic Carbon (TOC), sulfide, sulfate, and CLP parameters including the selected list of TAL constituents, TCL Volatile Organics, TCL Semivolatile Organics, and Pesticides/PCBs. The remaining samples were analyzed for selected organic indicator contaminants using a laboratory screening technique.

Five additional cores (3 in the basin and 2 in the wastewater ditch) were obtained during the Phase II sampling. The core locations and analytical parameters were based on the results of the Phase I sampling.

OU-2, Surface Water Sampling

Surface water samples were collected from discrete depths at randomly selected grid locations in the basin. Surface water samples were also obtained from each of the drainages to the basin that contain water. The water samples were analyzed by CLP procedures for TAL mercury (total and dissolved), the selected list of other TAL constituents, TCL Volatile Organics, TCL Semivolatile Organics, and TCL Pesticides/PCBs. Non-CLP analyses included Dissolved Oxygen (DO), pH, TOC, Total Suspended Solids (TSS), and Total Dissolved Solids (TDS).

OU-2, Fish Sampling

Twenty specimens of two fish species (largemouth bass and channel catfish) were collected for chemical analyses. Ten whole body samples and 10 filet samples were obtained from each species. The 40 fish samples were sent under chain-of-custody to Hazleton Environmental Services, Madison, Wisconsin, for analysis of chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, pentachlorobenzene, hexachlorobenzene, pentachloronitrobenzene, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and percent lipids. Hazleton Laboratory prepared aliquots of the fish samples and submitted these aliquots to Olin's laboratory in Charleston, Tennessee for total mercury analysis. Only filet samples were used in the exposure assessment.

Future Sampling

More extensive sampling is planned for OU-1. The planned sampling is to address the Old Plant (CPC) Landfill, which was identified as a potential continuing source of groundwater contamination, and other SWMUs/AOCs identified in the RCRA Facility Assessment (RFA). During the scoping of the RI/FS the potential for exposure due to surface and subsurface soils was considered to be low due to the closure and removal activities that have been conducted at the site. Based on this characterization, the surface and subsurface soils will be addressed qualitatively in the baseline risk assessment. However, the additional sampling that is planned includes soils in OU-1.

If these data indicate potentially significant concentrations based on the additional sampling, the baseline risk assessment will be revised to incorporate the additional data.

Additional sampling is also planned for OU-2. The planned sampling will include additional grab samples from the basin flood plain and the round pond to the north of the basin. An additional core is also planned for the wastewater ditch. The sampling results will be evaluated to assess whether the additional data affect the exposure assessment presented in this document. Any modification to the exposure assessment based on this additional data will be incorporated into the baseline risk assessment.

4.0
EXPOSURE PATHWAYS

An exposure pathway describes a specific environmental transport pathway by which receptor populations can be exposed to chemical constituents present at or originating from a site. An exposure pathway consists of four necessary elements:

- A source and mechanism of chemical release to the environment
- An environmental transport medium for the released chemical
- A point of potential human contact with the medium and the receptors located at these points
- A human uptake route (intake of media containing site-related chemicals) at the point of exposure

All four elements must be present for an exposure pathway to be complete and for exposure to occur. All potential exposure pathways are evaluated for each identified receptor to determine their significance. Complete exposure pathways are quantitatively addressed in this exposure assessment. Incomplete exposure pathways do not result in actual human exposure and therefore are not included in the exposure assessment.

4.1 CHEMICAL SOURCE RELEASE MECHANISMS AND TRANSPORT MEDIA

At the Olin-McIntosh site, chemicals may reach either on-site or offsite receptors via groundwater, surface water, sediments and fish ingestion. The chemical source release mechanisms and transport media can be further delineated for purposes of this exposure assessment as follows:

- Chemical sources in OU-1 include surface and subsurface soils which may be released through the groundwater, runoff, wind erosion or direct contact.

- Chemical sources from the wastewater ditch in OU-2 may be released through surface water and sediment media in the natural basin wetlands area through infiltration into groundwater, overflow and subsequent runoff or by direct contact. Exposure pathways include fish consumption, dermal contact and ingestion of surface water and sediments.

4.2 EVALUATION OF POTENTIAL EXPOSURE PARAMETERS

In order to calculate the daily chemical intake (CDI), a number of exposure parameters must first be quantified. Parameters which are typically quantified include the following:

- Exposure frequency (days/year)

- Exposure time (hrs/day)

- Exposure duration (years)

- Groundwater ingestion rate (l/day)

- Surface water and sediment ingestion rates (l/day and mg/day)

- Body weight (kg)

- Body surface area (m^2)

- Lifespan (days)

- Fish (locally caught) ingestion rates (g/day)

These parameters are assigned numerical values (Tables 2 through 9) which are incorporated into one of the exposure algorithms used to estimate the extent of chemical exposure. The numerical values used in the exposure algorithm have been developed using the Exposure Factors Handbook (EPA 1989a) and OSWER Directive 9285.6-03 (Standard Default Exposure Factors; EPA 1991) and the Risk Assessment Guidance for Superfund (RAGS) Manual (EPA 1989b). Exposure assumptions used are conservative to ensure that potential exposures are not underestimated. A discussion of these assumptions is presented in Section 6.2.

4.3 POTENTIAL RECEPTOR POPULATIONS

The populations on and near the site were characterized in order to assess the likelihood and extent of exposure to site contaminants. The current use of the land in the vicinity of the site is commercial to the north and residential to the south. Since Olin owns the property currently occupied by the plant, future land use is likely to remain industrial. Area residents (adults and children), current and future industrial workers, and future remediation workers were identified as potential receptor populations from the site. However, a well managed Health and Safety Plan implemented for current and future industrial workers would eliminate potential for dermal exposure to groundwater from monitoring wells at OU-1 (29 CFR 1910.120). Therefore, current and future industrial workers were not quantitatively addressed in this exposure assessment.

Sensitive receptors within the study area are those who might be particularly susceptible to chemicals. They may include infants, the elderly, or individuals with respiratory problems. Sensitive receptor locations generally include hospitals, convalescent homes, schools, and day care centers. Offsite residential children are identified as the sensitive receptors for this assessment and are evaluated in residential and trespasser exposure scenarios.

4.3.1 Potential Residential Receptors

Current potential residential receptors (offsite) live in the residential areas south of the Olin McIntosh plant. Locations of these residential receptors are given in Figure 1 and can be found in the Land Use and Demographic Analysis (Appendix A).

The specific residential receptors for which quantitative exposures were calculated in the exposure assessment included adult and children residents. These receptors potentially lie in the path of groundwater flow. Furthermore, residential adult and children receptors could possibly ingest some fish from OU-2 and come into contact with OU-2 surface water and sediments. The child resident represents a sensitive subpopulation that may potentially be at greater risk due to behavior patterns or sensitivity to chemical constituents. Trespassers are also included in the offsite adult and child residential receptor populations.

4.3.2 Potential Occupational Receptors

Quantitative exposures were not calculated for the plant industrial worker since complete exposure pathways do not exist for this receptor. For instance, industrial workers are not likely to be exposed to surface water, sediments or fish from OU-2 because plant operations do not require workers in OU-2. Although plant workers sample groundwater from monitor wells and corrective action wells quarterly, exposure to groundwater can be controlled by implementation of proper health and safety procedures.

4.3.3 Hypothetical Receptor Populations

In addition to the current offsite residential and chemical worker receptors, hypothetical receptor sites addressed in the exposure evaluation included points where remediation might occur in OU-2. Exposure of site contaminants to a hypothetical receptor, a future remediation worker, was evaluated. This receptor could be potentially exposed to surface water and sediments by ingestion and dermal routes of exposure.

A second hypothetical receptor, a future industrial worker, was evaluated for OU-1. However, there is no current or likely future exposure to groundwater containing site chemicals by workers if appropriate health and safety procedures are implemented. Future exposure assessments may quantitatively address the contribution of surface and subsurface soil contamination once data for this medium becomes available (see Section 3.0).

4.4 EXPOSURE POINTS

An exposure point is defined as a location of potential contact between a receptor population and a chemical constituent. The objective of determining exposure points is to identify location points where receptor populations may be potentially exposed to chemical constituents contained within environmental transport media. For this exposure assessment, potential media of concern include groundwater, surface water, sediments and fish.

Under the baseline scenario, the following discreet exposure points were identified for potential exposure to the chemicals of concern via groundwater: south residences, the Olin McIntosh Chemical plant facility, and the 65-acre natural basin and the associated undeveloped area of the Olin McIntosh property. Domestic well water presents both dermal and ingestion exposure pathways for offsite adult and child residents. The measured concentrations in the domestic wells were used to calculate potential exposures to site constituents via groundwater media. Appendix B presents the data that were used in these calculations.

The potentiometric surface indicates that on-site groundwater from current and past potential sources is being captured by the groundwater corrective action system. However, the residences south of the facility are considered as exposure points due to the potential for past contaminant migration to the south.

The wetlands (OU-2) were selected as exposure points for contaminated surface water, sediments and fish for area resident trespassers who use the natural basin for recreational and hunting/fishing purposes. In addition, OU-2 surface water and sediments may present exposure to site contaminants for future remedial workers. Potential exposures to offsite receptors were calculated using measured concentrations of potential chemicals of concern in surface water, sediment, and fish collected from OU-2. These data are presented in Appendix B. For the fish data, only the filet analyses were used in the calculations since the exposure assessment addresses only human health concerns. Whole body analyses of fish will be used in preparation of the Environmental Evaluation Technical Memorandum which will be submitted at a later date.

4.5 HUMAN INTAKE ROUTES

A human intake route is the mechanism by which a chemical comes in contact with the receptor. Humans may take up chemicals via inhalation, ingestion, or dermal contact. Each exposure pathway is evaluated for uptake potential. The human exposure routes identified for exposure to the constituents of potential concern present at or originating from the Olin site (OU-1 and OU-2) are presented below in Section 4.6. Inhalation exposure risks were not evaluated quantitatively for any media in the exposure assessment for two reasons. First, inhalation of VOC's at the site was not considered to be a significant exposure pathway. This is due to low concentrations of these materials present in environmental media, dilution factors, meteorological conditions and low exposure. Second, inhalation (and subsequent absorption or incidental ingestion) of particles of respirable size (i.e., $< 10\ \mu M$) from surface soil fugitive dust emissions was not considered significant due to the post closure and removal activities of the solid waste management units. Additional soil sampling is planned as outlined in Section 3.3 and future exposure scenarios may address this pathway quantitatively based on the additional data. However, the overall contribution of fugitive dust intake to total exposure at the Olin site is expected to be insignificant in comparison to exposure of potential receptors to other contaminated media. This is due to the significant concrete, asphalt and vegetative cover at the site and the insignificant generation of dust due to that cover.

4.6 INTEGRATION OF EXPOSURE PATHWAY COMPONENTS: THE SITE CONCEPTUAL EXPOSURE MODEL

The following section combines information from primary sources of contaminants, chemical release mechanisms, transport media, potential receptors, exposure routes and subsequent complete exposure pathways for site contaminants at OU-1 and OU-2. All potential exposure pathways are combined into integrated site conceptual exposure models shown in Figures 4 and 5. These figures indicate complete and incomplete pathways and corresponding significant and insignificant exposure pathways. Figures 4 and 5 represent the cumulative information needed to evaluate whether pathways are complete and/or significant. This includes input on chemical concentrations, chemical migration, health and safety plan implementation, demographics, etc. Complete pathways are designated by a solid dot, while an "I" designates incomplete pathways. Exposure routes that are not applicable to a media are designated as "NA." Those exposure pathways that are significant are represented with a solid circle and an open circle represents those pathways which are assumed to be relatively insignificant based on professional judgment. The two site conceptual exposure models represent two primary sources of chemicals:

- Surface and subsurface soils from Olin McIntosh Chemical Plant (OU-1)

- Wastewater Ditch/Olin Basin (surface water and sediments) (OU-2)

4.7 SUMMARY OF EXPOSURE PATHWAYS

<u>OU-1</u>

There were no complete significant exposure pathways identified for current and future industrial workers. Complete exposure pathways for dermal exposure and ingestion of groundwater exists for offsite residential adults and children.

Direct contact exposure to surface soils from OU-1 (dermal, ingestion) by current and future industrial workers and future remediation workers are considered a complete exposure pathway but are not considered significant. Similarly, direct contact to fugitive dusts (i.e., particulates) could present complete exposure pathways for these receptors through dermal, ingestion and inhalation routes. Based on obtaining additional soil data, these exposures may be addressed in future exposure scenarios.

<u>OU-2</u>

For this exposure assessment, the majority of complete exposure pathways were associated with chemical sources from OU-2. Because of activity patterns and fencing in the plant area, OU-2 surface water and sediments are not contacted by plant workers at the site. Therefore, primary receptors for OU-2 associated exposures include future remediation workers, offsite residential adults and children. Offsite residents are believed to trespass on OU-2. Therefore, trespasser exposure scenarios are included in offsite resident (adults and children) exposure possibilities. This approach is conservative in that it treats offsite residents and trespasser exposure scenarios as additive.

Complete exposure pathways exist for direct contact of OU-2 surface water and sediment via dermal and ingestion exposure routes for future remediation workers, offsite residential adults and children. This could occur during future remediation work (i.e., future workers) or through fishing and wading (i.e., residents) during trespass situations. Similarly, ingestion of fish from OU-2 by offsite residents constitutes a complete exposure pathway. Inhalation of constituents from groundwater is believed to be negligible at this site. The potential for groundwater contamination from OU-2 sediments is characterized as minimal and was therefore not considered a complete exposure pathway in this assessment.

As indicated for OU-1, surface soils contaminated through run-off scenarios could produce dermal, ingestion and inhalation exposures for future remedial workers. Similarly, surface soils could produce exposures to offsite residents (i.e., trespassers). However, due to the likelihood that such exposures would be minimal, these pathways were not addressed quantitatively in the exposure assessment. Quantitative evaluations may be conducted in the future based on additional data that will be collected.

Summary

In summary, pathways that will quantitatively be evaluated for the Olin McIntosh Chemical Plant are as follows:

- Under the baseline scenario, the exposure pathways identified for receptor populations for OU-1 are:
  - dermal exposure to groundwater for area residents (adults and children) during showering, gardening, etc., with residence well water
  - ingestion of groundwater for area residents who use well water for drinking water

- Under the baseline scenario, the exposure pathways identified for OU-2 are:
  - dermal exposure to surface water and sediment from direct contact by area residents during recreational activities in the basin
  - incidental ingestion exposure to surface water and sediment from direct contact by area residents during recreational activities in the basin
  - ingestion exposure from fish caught from OU-2 and eaten by area residents

- Under the hypothetical scenario, exposure pathways identified for chemical sources from OU-2 are:
  - dermal and ingestion exposure to surface water and sediments by the future remediation worker during remediation activities in the basin

Pathways that will be qualitatively addressed in the baseline risk assessment will include onsite and offsite surface soil exposure to area residents and workers including fugitive dust inhalation, incidental ingestion and dermal contact. Quantitative evaluation of these pathways may be included in the baseline risk assessment pending results from future sampling activities.

5.0
EXPOSURE POINT CONCENTRATIONS

Exposure point concentrations are the chemical concentrations to which a receptor is exposed when contact is made with a specific environmental medium. The chemical concentrations for the sample media are presented in Tables 10 through 13 for:

- Domestic well water concentrations (Table 10)
- Surface water (OU-2) from Olin Basin/Wastewater Ditch (Table 11)
- Sediment (OU-2) from Olin Basin/Wastewater Ditch (Table 12)
- Fish (OU-2) from Olin Basin (Table 13)

The tabulated results for each medium include the number of records, number of detections, the arithmetic mean for each constituent, the sample standard deviation and the 95 percent upper confidence limit of the arithmetic mean. Calculations for arithmetic means and 95 percent upper confidence limits include the use of one-half of the detection limit for samples considered "non-detects." The use of the arithmetic mean as recommended by the guidance document (RAGS 1989b) is a conservative approach. A more realistic approach may be to use the geometric average in cases where environmental data may be skewed resulting in overestimation of risks. For the baseline risk assessment, a statistical distribution analyses of the data may be conducted which may result in the use of the geometric, rather than the arithmetic, mean to be used for risk/hazard number calculations. The data for each of these media are presented in Appendix B.

6.0
QUANTIFICATION OF EXPOSURE

The next step in the exposure assessment is to quantify the magnitude, frequency, and duration of exposure for the defined receptor populations. This step is conducted by integrating 1) exposure concentration estimations for each chemical, and 2) intake estimates for each of the pathways considered in this assessment. Some general considerations in quantifying exposure are presented in the remainder of this report.

6.1 QUANTIFYING AVERAGE AND REASONABLE MAXIMUM EXPOSURES

Exposure to a chemical is described in terms of intake, which is expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day). The magnitude of exposure to a chemical (or intake) is a function of a number of variables, including exposure concentration and variables that describe the exposed population (e.g., contact rate, exposure frequency and duration, and body weight). Each of these parameters can be described by a range of variables. For purposes of this assessment, two measures of exposure have been defined using two sets of exposure variables: an average exposure and a reasonable maximum exposure.

The arithmetic mean of the chemical concentration in domestic wells, surface water, sediments, and fish tissue sample were calculated, along with the sample standard deviation. In locations where the chemical was reported as undetected, the chemical was assumed to be present at one-half of the detection limit. From this information, a 95 percent upper confidence limit (UCL) of the arithmetic mean was calculated, using the "t" distribution. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was adopted as the exposure point concentration for each chemical. Use of the maximum concentration, if less than the upper bound, is supported by EPA risk assessment guidance for the calculation of the RME (EPA 1989b). The upper bound concentration may exceed the maximum concentration in instances where the variation of the data is large or when high detection limits (above concentrations detected in other samples) may inaccurately skew the upper bound concentration.

The average exposure is estimated using the arithmetic average of measured chemical concentrations and exposure variables that represent central values or best estimates of exposure for an individual with normal activity patterns.

The reasonable maximum exposure has been estimated using guidance provided in EPA's Risk Assessment Guidance for Superfund (RAGS) (EPA 1989b). The reasonable maximum exposure is defined by selecting intake variable values so that the combination of all intake variables results in a maximum exposure that is reasonably expected to occur at the site. The RME represents the 90th percentile exposure, that is, the exposure expected to occur in 1 of every 10 exposed individuals. The intent of the reasonable maximum exposure is to estimate a conservative, well above average exposure case that is still within the range of possible exposures. The USEPA recommends that the 95 percent upper confidence limit (UCL) on the arithmetic average be used for this variable in characterizing the reasonable maximum exposure because of uncertainty surrounding any estimate of exposure concentration.

6.2 EXPOSURE ASSUMPTIONS

Specific exposure values were developed for each receptor population and are listed in Tables 3 through 9. Lifespan, as given in the OSWER Directive 9285.6-03 (EPA 1991), is 70 years, and is the same for all receptors. All other values are receptor-specific.

Exposure duration refers to the number of years spent on or near the site or residence. Adult residents are assumed to have a reasonable maximum exposure duration of 30 years based on the upper 90th percentile value for time spent in a single residence while an average number of years an adult resident is assumed to spend at a residence is 9 years (Exposure Factors Handbook, EPA 1989a). Child residents are assumed to be raised in the same house (i.e., average exposure duration of 9 years) and to move away after becoming adults (i.e., RME of 20 years of age). This is particularly useful in evaluating non-carcinogenic (e.g., toxic) health hazards. Future remedial workers are assumed for this site to have an average exposure duration of 2 years and a reasonable maximum duration of 4 years.

Exposure frequency refers to the number of days per year spent at or near the site. The future remediation workers are assumed to spend 250 days per year on-site, based on a 5-day work week of 50 weeks per year (OSWER Directive 9285.6-03 (EPA 1991)). Exposure frequency for surface water and sediment exposures for residential receptors were estimated at 6 and 12 days/year for average and RME exposures, respectively.

Dermal exposure by residents to groundwater was assumed to be 350 days/year. Exposure time (hrs/day) to groundwater for dermal exposures was estimated to be 0.5 hrs/day and 1.0 hrs/day for residential average and reasonable maximum exposures, respectively.

Groundwater ingestion rates are based on data presented for a maximum and average intake rates in the Exposure Factors Handbook (EPA 1989a). Adult residents are assumed to drink a maximum of 2.0 liters of groundwater per day and 1.4 liters per day as an average exposure intake rate. The child resident groundwater ingestion rate is given as 1.0 liter per day as an average and RME.

Body weights have been derived from the OSWER Directive 9285.6-03 (EPA 1991). Body weight for adults is given as 70 kg, and includes both adult residents and remediation workers. Body weights for children age 0 to 20 years old are 18 kg as an average body weight as derived from 50th percentile of weights (Table 2) from the Exposure Factors Handbook (EPA 1989a), and 48 kg as a reasonable maximum body weight derived from the 90th percentile of child body weights in the same table.

The RAGS Manual (EPA 1989b) recommends use of the 50th percentile body surface areas for dermal exposure to groundwater during showering or bathing. The adult male surface area represents the average surface area exposure. Except for groundwater exposures to offsite residents while showering, one-tenth of the adult body surface area (19,400 cm^2) was assumed to be exposed in the average case, and 20 percent for the RME for sediment and surface water exposures. For the future remediation worker, 8 percent (i.e., head, Exposure Factors Handbook (EPA 1989a)) of the total surface area was used for the RME while one-half of 8 percent (4 percent) was used for average dermal exposure to water and sediment. A weighted average approach was used to estimate children body surface areas.

Sediment and soil ingestion rates are based on the average and reasonable maximum rates from the ingestion of soils (EPA 1989 RAGS). Soil consumption rates for the future remediation worker is expected to be much less (i.e., 10 percent of residential values) due to lower exposure and implementation of protective procedures.

Consumption rates for fish used site-specific factors to estimate the amount of fish ingested (IR) by area residents and the occurrence of eating fish from contaminated sources (FI). According to the Exposure Factors Handbook (EPA 1989a), recommendations for ingestion rates specify that "due to lack of data, no specific values are recommended for small bodies of water or for areas of localized contamination in large bodies of water." Therefore, specific intake factors for fish ingestion rates were developed according to the guidance presented in the Exposure Factors Handbook (EPA 1989b). Specifically, it is recommended that:

a. Local fisherman in the affected area be interviewed to obtain actual consumption rates
b. Productivity data be obtained for the area and divided by the number of recreational fisherman (and family members) in the area
c. fish consumption from the contaminated area be estimated
d. standard exposure scenarios assuming the number of fish meals eaten from the area per year be developed based on meal sizes ranging from 100 to 200 g/meal (EPA 1989b).

Based on information collected from the demographic analysis (Appendix A), the geometric mean number and 95 percent upper confidence limit of the mean number of meals of locally caught fish eaten by area residents was calculated as 25 and 65, respectively (N=32). This calculation was performed by assigning 365, 52, 12, 24, and 4 to daily, weekly, monthly, biweekly, and occasional responses, respectively, for fish consumption obtained from the demographic analysis. Applying 200 g/meal and 100 g/meal as RME and average consumptions, respectively, annual ingestion rates of 35.6 g/day and 6.8 g/day for RME and average exposures for offsite adult residents were produced (EPA 1989b). Offsite children ingestion rates were adjusted based on mass considerations.

Conservative estimates of the occurrence of offsite residents eating fish from contaminated sources (FI) was estimated to be 10 percent and 20 percent for average and RME exposures, respectively. This figure was derived using the demographic analysis and professional judgment. Since it is illegal for area residents to fish in the basin, no respondents mentioned fishing there. For the estimation of FI, the choice of the Tombigbee River was used to estimate intake of fish from potentially contaminated sources because it was not possible from the demographic analysis to separate residents who fish in the basin from those who fish in the river. In the demographic analysis, 68 percent (21/31) respondents claimed to fish at least some of the time in the Tombigbee River. The percentage of fishing time spent in the river was estimated to be 33 percent because of the abundant alternative fishing areas in the vicinity and the likelihood that climatic conditions (temperature, flooding, etc.) would not create attractive fishing conditions year round. Therefore, FI was estimated at approximately 20 percent (0.68 x 0.33) for RME exposure scenarios and one-half (10 percent) for average. It should be further noted that as a conservative approach, all fish consumption of the FI assumed contamination at concentrations reported in basin fish. Furthermore, the assumption is that all fish eaten are as contaminated as catfish and largemouth bass species, both of which are expected to contain the highest contaminant concentrations. Therefore, 10 percent and 20 percent should be acceptable for exposure estimates for this site.

For dermal contact with contaminants in water, a dermal permeability constant for water (8.0×10^{-4} cm/hr) was used (Superfund Exposure Assessment Manual, EPA 1988) to be conservative since metal permeabilities through skin in general are low in aqueous media.

Soil loading (i.e., adherence factor) on skin was assumed to be approximately 0.60 mg/cm^2 (Exposure Factors Handbook, EPA 1989a). For dermal contact with sediments, an absorption factor of 0.05 and 0.10 was applied for the average and RME, respectively. Ten percent absorption was considered maximum since even lipid soluble materials are only 35 to 50 percent absorbed (Wester, et al., 1990) assuming 24 hour exposures. Two to four hour (i.e., 10 to 20 percent) exposures are more likely, thus the use of 0.05 and 0.10 as absorption factors are conservative.

The matrix effect (ME) describes the observation that chemicals bound to soil are less well absorbed than are chemicals administered in drinking water, corn oil, or other typical laboratory dose vehicles. Studies have shown that materials may remain adsorbed to a matrix and are subsequently less available for absorption (Goon et al., 1991). Therefore, 50 percent (or 0.5) was used as a conservative estimate of the matrix effect in this analysis.

Finally, since some areas and media on the Olin site are not 100 percent contaminated, it is unlikely that receptors will continuously come into contact with solely contaminated media. Most trespassers in OU-2 would spend a majority of the time in the flood plain area and along the basin shoreline and not in contact with basin sediments. The contaminated fraction (FI) of sediment at this site was estimated to be 10 percent and 20 percent for average and RME. This estimate may be revised based on the analyses of additional sediments collected from OU-2 which will include sediments from the flood plain.

7.0
CALCULATION OF DAILY CHEMICAL INTAKES

Daily chemical intakes (CDIs) represent the daily amount of chemicals in milligrams taken in by a receptor per kilogram of body weight (mg/kg-day). The CDIs are used to estimate the potential human health risks (i.e., hazard quotients and cancer risks) associated with each chemical. The CDIs are calculated for individual chemicals and receptors, using the following equation:

$$CDI = \textit{Intake Factor} \times \textit{Exposure Point Concentration}$$

Intake factors (IFs) are developed using the potential exposure parameters discussed in Section 6.2 and the formula presented below:

$$\textit{Intake Factor} = \frac{\textit{contact rate} \times \textit{exposure frequency} \times \textit{exposure duration}}{\textit{body weight} \times \textit{averaging time}}$$

A complete set of intake factor detail is presented in Appendix C. It should be noted that the IFs (and their associated CDIs) to be subsequently used for calculating hazard quotients (HQs) are different than those used to estimate cancer risks (CRs). The IFs to be used to calculate HQs are developed using the exposure period as an averaging period, while the IFs used for calculating potential CRs assume lifetime as the averaging period. The pathway-specific CDIs calculated for each chemical for the various exposure scenarios are presented in Appendix D.

8.0 UNCERTAINTIES AND LIMITATIONS

It was assumed that samples collected were representative of conditions to which various populations may be exposed. However, the collected samples may not be perfectly representative, due to biases in sampling and to random variability of samples. In general, sampling in the RI was biased toward areas of known and suspected elevated chemical concentrations, which may lead to an overestimation of exposure when these results are assumed to represent a larger area (e.g., when samples from an area of concentrated chemicals are used to characterize exposure over a large area, much of which may not be impacted by site activities). In addition, the environmental media sampled are not homogeneous. Random variability of the media sampled may result in the samples collected either over or underestimating the actual exposures.

Samples were analyzed using Contract Laboratory Procedures (CLP) procedures and were subjected to data validation to obtain data suitable for decision-making. However, it should be understood that sample analysis is subject to uncertainties associated with precision, accuracy, and detection of chemicals of low concentrations. Analytical precision and accuracy are evaluated through laboratory QA programs. Uncertainties associated with precision and accuracy of analysis are generally random errors which may lead to over or underestimation of exposures. These errors are typically of low magnitude (well below an order of magnitude) compared to other sources of uncertainty of the exposure assessment.

Due to the limits of analytical methodologies and the complexity of matrices for environmental samples, some chemicals present in low concentrations in samples may not be detected, leading to a possible underestimation of exposure. This however is unlikely since one-half of the detection limit was used for "nondetects."

In compiling most of the data for use in the exposure assessment, arithmetic means and 95 percentile upper confidence limits (UCL) on the arithmetic mean concentrations of chemicals detected in each media were compiled. In compiling data, one half of the detection limit was used for those samples which contained chemical concentrations below the detection limit. This assumption is conservative and may lead to overestimation of exposure, particularly for those chemicals reported with low frequency and low concentrations. The arithmetic mean concentration was used in evaluation of average exposures, an assumption which does not over or underestimate exposure. In estimating RME exposures, the 95th percentile UCL concentrations were used, which may result in overestimation of potential exposures.

For the most part, the arithmetic mean and 95 percent UCL chemical concentrations were used as exposure point concentrations. It was conservatively assumed that chemical concentrations observed at the site study area will remain unchanged with time. The potential reduction in chemical concentrations by migration, degradation, and attenuation were not considered. These processes would reduce the chemical concentrations present at the site during the assumed exposure periods considered in the risk assessment. Therefore, the use of existing chemical concentrations and exposure periods projected into the future is conservative and may result in overestimating the potential health risk at the site.

The exposure assessment relied on assumptions of a wide variety of scenarios for potential human exposure. The exposure scenarios used are considered conservative and are likely to overestimate risk. Assumptions used were based on:

- Site-specific information
- USEPA Guidance (RAGS 1989b) and the Exposure Factors Handbook (USEPA 1989a)
- Professional Judgement

The average case scenarios represent assumptions which are considered central values, or realistically conservative estimates for the exposed population. However, even the average case scenarios assume individuals are exposed on a regular basis over a long period of time, which is an assumption that likely overestimates actual exposures. The

RME scenarios are developed to subsequently provide an upper bound risk estimate. The RME scenarios are based upon combinations of conservative assumptions for all variables related to exposure, and thus are highly likely to overestimate potential exposures, possibly by a large amount (one or more orders of magnitude).

Assumptions concerning most of the generic (non-site specific) variables used in estimating chemical intakes are based upon data collected for human populations, and thus are subject to limited uncertainty. These include variables such as body weights, ingestion rates, surface area, etc. There is greater uncertainty associated with assumptions concerning soil ingestion rates, dermal absorption factors, and absorption of chemicals from complex matrices (such as soil) into the body. These assumptions may lead to over or underestimation of exposure. As stated earlier the general approach used in this assessment was to use conservative assumptions for intake variables in the absence of strong scientific data, thus minimizing the likelihood that exposures are underestimated.

9.0
CONTAMINANT FATE AND TRANSPORT

The exposure pathways identified under the baseline scenario for receptor populations included exposure of area residences to offsite groundwater, exposure of area residences and trespassers to sediments and surface water in the basin, and exposure to fish caught from the basin and eaten by area residences. Contaminant fate and transport models were not considered necessary to adequately characterize these exposure pathways.

Offsite exposure to groundwater was calculated based on sample results from the area drinking water wells rather than using contaminant fate and transport analyses to predict contaminant concentrations. This is considered a conservative assumption considering that the onsite potentiometric data show that all past and present known sources are being captured by the corrective action wells, and therefore offsite concentrations should decrease with time.

Contaminant fate and transport models were also not used for exposure to OU-2 sediment, surface water and fish. Again, long-term exposure was assumed to be at present concentrations. The potential for contaminant migration in the groundwater at OU-2 is characterized as minimal as described in the Preliminary Site Characterization Summary submitted to EPA on April 16, 1992; therefore, contaminant transport models for groundwater contaminant migration in OU-2 were not considered necessary. Sediment transport in OU-2 was not evaluated quantitatively because any modeling of sediment transport in the basin would have to take into account the complex hydrodynamics of the basin, and the seasonal interaction between the basin and the adjacent Tombigbee River. Such a modeling effort was not considered appropriate. Rather, the transport of sediment beyond the boundaries of the basin will be evaluated using the sampling data that will be collected from the basin flood plain.

An evaluation of contaminant fate and transport will be included in the RI report. It is believed however, that the fate and transport evaluation will not affect the exposure scenarios and quantitative evaluation of exposure presented in this document.

10.0
SUMMARY/CONCLUSIONS

The following conclusions are based on information detailed in the exposure assessment. Clearly, the chemicals of potential concern that are present in the highest concentrations, that possess the highest intrinsic toxicity, and that also have the highest intake would subsequently be responsible for driving the health risks at the site. In general, pathways that showed the lowest chemical intakes (i.e., 1.0 x 10^{-6}mg/kg/day or less) included dermal exposures to surface water, groundwater, and sediment, and ingestion of sediment and surface water. Ingestion of groundwater and fish were associated with the highest chemical intakes at the site. Of these 2 media (groundwater, and fish), daily intakes by residential receptors of contaminants of concern through the ingestion of fish were associated with the highest exposures to chemicals capable of driving the human health risks/hazards at the site; most notably 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, hexachlorobenzene and mercury.

Fish intake assumptions were generated for this exposure assessment by using information documented in the demographic analysis. This approach conservatively estimated site-specific ingestion rates for area residents. The fraction of fish ingested by area residents from contaminated sources was estimated as 10 percent and 20 percent for average and RME scenarios, respectively. To be conservative, the "fraction contaminated" intake parameters (10 percent and 20 percent) included the possibility of residents eating Tombigbee River fish as well as basin fish. From the demographic analysis, it was not possible to separate (and relate) the contribution of basin-related contamination and Tombigbee River-based contamination to overall exposure to offsite residents. Therefore, exposure scenarios such as those described in this document, addressed this relationship by combining potential exposures from these two sources (i.e., basin and Tombigbee River). Even more conservative was the assumption that every (i.e., 100%) of fish contained concentrations of potential contaminants of concern similar to concentrations recorded from fish sampled from the basin.

In summary, the fish ingestion pathway is the major source of exposure to site constituents, including constituents not related to the Olin McIntosh facility (i.e., the DDT compounds). The hazards/risks associated with the fish ingestion pathway and other exposure pathways presented in this document will be quantified in the baseline risk assessment, which will be submitted at a later date.

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TABLES

TABLES

Woodward-Clyde Consultants

TABLE 1 3 8 0806

CHEMICALS OF POTENTIAL CONCERN

	Carcinogens	Noncarcinogens
Surface Water	Alpha-BHC Arsenic Lead	Arsenic Cadmium Cyanide Chromium Lead Mercury Nickel Zinc
Sediment	Arsenic Benzene Chromium Hexachlorobenzene Lead	Chromium Hexachlorobenzene Lead Mercury
Domestic Well Water	1,1,2,2-Tetrachloroethane Chloroform Tetrachloroethene	Chlorobenzene Chloroform Mercury Tetrachloroethene
Fish	4,4'-DDD 4,4'-DDE 4,4'-DDT Hexachlorobenzene	4,4'-DDT Hexachlorobenzene Mercury

TABLE 2

TIME-WEIGHTED AVERAGE BODY WEIGHT FOR CHILDHOOD EXPOSURES

Age	Years in Age Group	Weight, kg
0 < 3	3	11.6
3 < 6	3	17.4
6 < 9	3	25.0
9 < 12	3	36.0
12 < 15	3	50.6
15 < 18	3	61.2
18 < 30	12	70
Time-Weighted Average Body Weight Child (0 to 9 years) 18 kg Child (0 to 30 years) 48 kg		

Source: EPA (1989)

TABLE 3 3 8 0808

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY INGESTION OF GROUNDWATER

Parameter	Offsite Residential			
	Child		Adult	
	AVG	RME	AVG	RME
Ingestion Rate	1.0 L/day	1.0 L/day	1.4 L/day	2.0 L/day
Frequency/Year	350 days	350 days	350 days	350 days
Body Weight	18 kg	48 kg	70 kg	70 kg
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
Exposure Period	9 years	20 years	9 years	30 years

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.

TABLE 4

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY INGESTION OF SURFACE WATER

	Offsite Residential				Future Remedial	
	Child		Adult		Worker	
Parameter	**AVG**	**RME**	**AVG**	**RME**	**AVG**	**RME**
Ingestion Rate	0.05 L/day	0.1 L/day	0.05 L/day	0.1 L/day	0.05 L/day	0.05 L/day
Frequency/Year	6 days/yr	12 days/yr	6 days/yr	12 days/yr	250 days/yr	250 days/yr
Body Weight	18 kg	48 kg	70 kg	70 kg	70 kg	70 kg
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
Exposure Period	9 years	20 years	9 years	30 years	2 years	4 years

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.

TABLE 5

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY INGESTION OF SEDIMENT

Parameter	Offsite Residential				Future Remedial	
	Child		Adult		Worker	
	AVG	RME	AVG	RME	AVG	RME
Ingestion Rate	100 mg/day	200 mg/day	50 mg/day	100 mg/day	5 mg/day	10 mg/day
Frequency/Year	6 days	12 days	6 days	12 days	250 days	250 days
Body Weight	18 kg	48 kg	70 kg	70 kg	70 kg	70 kg
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
Exposure Period	9 years	20 years	9 years	30 years	2 years	4 years
Matrix Effect	0.5	0.5	0.5	0.5	0.5	0.5
action Contaminated	0.1	0.2	0.1	0.2	0.1	0.2
Conversion Factor	$1x10^{-6}$ kg/mg	$1x10^{-6}$ kg/mg	$1x10^{-6}$ kg/mg	$1x10^{-6}$ kg/mg	$1x10^{-6}$ kg/mg	$1x10^{-6}$ kg/mg

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.

TABLE 6

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY INGESTION OF FISH/GAME

Parameter	Offsite Residential			
	Child		Adult	
	AVG	RME	AVG	RME
Ingestion Rate	1,749 mg/day	24,411 mg/day	6,800 mg/day	35,600 mg/day
Frequency/Year	365 days	365 days	365 days	365 days
Body Weight	18 kg	48 kg	70 kg	70 kg
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
Exposure Period	9 years	20 years	9 years	30 years
Matrix Effect	0.5	0.5	0.5	0.5
*Fraction Ingested from Contaminated Source	.10	.20	.10	.20
Conversion Factor	1×10^{-6} kg/mg	1×10^{-6} kg/mg	1×10^{-6} kg/mg	1×10^{-6} kg/mg

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.
* = A complete description for the derivation of this parameter is provided in Section 6.2.

TABLE 7

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY DERMAL EXPOSURE TO GROUNDWATER

Parameter	Residential			
	Child		Adult	
	AVG	RME	AVG	RME
Body Surface Area	12,120 cm^2	12,120 cm^2	19,400 cm^2	19,400 cm^2
Dermal Permeability Constant	.0008 cm/hr	.0008 cm/hr	.0008 cm/hr	.0008 cm/hr
Body Weight	18 kg	48 kg	70 kg	70 kg
Exposure Time	0.5 hr/day	1 hr/day	0.5 hr/day	1 hr/day
Frequency	350 days/yr	350 days/yr	350 days/yr	350 days/yr
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
Exposure Period	9 years	20 years	9 years	30 years
Conversion Factor	$1x10^{-3}$ l/cm^3	$1x10^{-3}$ l/cm^3	$1x10^{-3}$ l/cm^3	$1x10^{-3}$ l/cm^3

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.

TABLE 8

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY DERMAL EXPOSURE TO SEDIMENT

Parameter	Residential				Future Remedial	
	Child		Adult		Worker	
	AVG	RME	AVG	RME	AVG	RME
Body Surface Area	1,212 cm^2	2,424 cm^2	1,940 cm^2	3,880 cm^2	776 cm^2	1,552 cm^2
Adherence Factor	0.6 mg/cm^2	0.6 mg/cm^2	0.6 mg/cm^2	0.6 mg/cm^2	0.6 mg/cm^2	0.6 mg/cm^2
Body Weight	18 kg	48 kg	70 kg	70 kg	70 kg	70 kg
Matrix Effect	0.5	0.5	0.5	0.5	0.5	0.5
Frequency	6 days/yr	12 days/yr	6 days/yr	12 days/yr	250 days/yr	250 days/yr
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
ɔosure Period	9 years	20 years	9 years	30 years	2 years	4 years
Absorption Factor	.05	.1	.05	.1	.05	.1
Fraction Contaminated	0.1	0.2	0.1	0.2	0.1	0.2
Conversion Factor	1×10^{-6} kg/mg	1×10^{-6} kg/mg	1×10^{-6} kg/mg	1×10^{-6} kg/mg	1×10^{-6} kg/mg	1×10^{-6} kg/mg

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.

TABLE 9

EXPOSURE PARAMETERS FOR ESTIMATION OF CONTAMINANT INTAKE BY DERMAL EXPOSURE TO SURFACE WATER

Parameter	Offsite Residential				Future Remedial	
	Child		Adult		Worker	
	AVG	RME	AVG	RME	AVG	RME
Body Surface Area	1,212 cm^2	2,424 cm^2	1,940 cm^2	3,880 cm^2	776 cm^2	1,552 cm^2
Dermal Permeability Constant	.0008 cm/hr	.0008 cm/hr	.0008 cm/hr	.0008 cm/hr	.0008 cm/hr	.0008 cm/hr
Body Weight	18 kg	48 kg	70 kg	70 kg	70 kg	70 kg
Exposure Time	2 hrs/day	4 hrs/day	2 hrs/day	4 hrs/day	4 hrs/day	8 hrs/day
Frequency	6 days/yr	12 days/yr	6 days/yr	12 days/yr	250 days/yr	250 days/yr
Days/Lifetime	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4	2.56×10^4
Exposure Period	9 years	20 years	9 years	30 years	2 years	4 years
Conversion Factor	1×10^{-3} l/cm^3	1×10^{-3} l/cm^3	1×10^{-3} l/cm^3	1×10^{-3} l/cm^3	1×10^{-3} l/cm^3	1×10^{-3} l/cm^3

NOTES:

AVG = Average Exposure.
RME = Reasonable Maximum Exposure.

TABLE 10

DOMESTIC WELL WATER CONCENTRATIONS OF CHEMICALS OF POTENTIAL CONCERN

Compound	No. of Records	No. of Detections	Arithmetic Mean (mg/l)	Sample Standard Deviation	95% Upper Confidence Limit of Mean (mg/l)
*1,1,2,2-Tetrachloroethane	34	1	.000979	.000120	.001014
*Chlorobenzene	34	1	.000976	.000137	.001016
Chloroform	34	8	.001520	.002377	.002210
*Mercury	34	1	.000107	.000046	.000121
*Tetrachloroethene	34	1	.000979	.000120	.001014

NOTE: * To be conservative these chemicals were included even though detected in one sample. Since concentrations are predominantly based on values below the detection limit and the assumption is that chemicals are present at one-half the detection limit, exposures will be overestimated.

TABLE 11

SURFACE WATER (OU-2) CONCENTRATIONS OF CHEMICALS OF POTENTIAL CONCERN

Compound	No. of Records	No. of Detections	Arithmetic Mean (mg/l)	Sample Standard Deviation	95% Upper Confidence Limit of Mean (mg/l)
Alpha-BHC	12	2	.000054	.000068	.000089
Arsenic	12	2	.002825	.003309	.004540
Cadmium	12	2	.001191	.000448	.001424
Chromium	12	7	.004758	.003062	.006346
Cyanide	12	7	.014958	.011538	.020940
Lead	12	3	.002041	.000982	.002550
Mercury	12	12	.001370	.000793	.001781
Nickel	12	7	.013266	.011994	.019485
Zinc	12	11	.131329	.110106	.188415

TABLE 12

SEDIMENT (OU-2) CONCENTRATIONS OF CHEMICALS OF POTENTIAL CONCERN

Compound	No. of Records	No. of Detections	Arithmetic Mean (mg/kg)	Sample Standard Deviation	95% Upper Confidence Limit of Mean (mg/kg)
Arsenic	27	27	6.085	3.526	7.243
Chromium	27	27	32.652	14.659	37.464
Hexachlorobenzene	47	24	56.736	158.147	95.467
Lead	27	27	21.714	9.369	24.790
Mercury	146	135	37.880	66.066	46.923
Benzene	39	7	0.117	0.384	0.221

TABLE 13

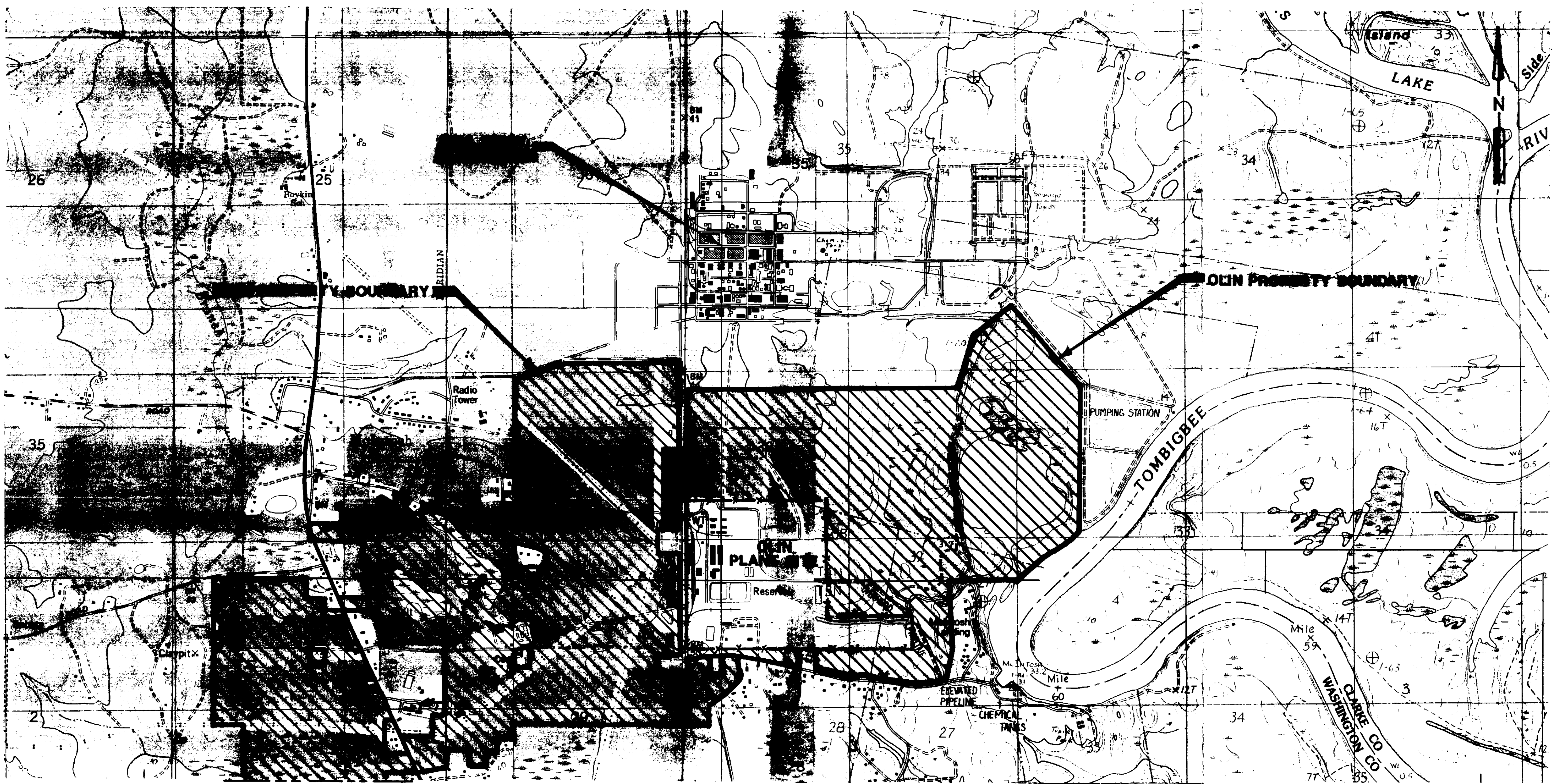
FISH (OU-2) CONCENTRATIONS OF CHEMICALS OF POTENTIAL CONCERN

Compound	No. of Records	No. of Detections	Arithmetic Mean (mg/kg)	Sample Standard Deviation	95% Upper Confidence Limit of Mean (mg/kg)
4,4'-DDD	20	20	1.413	1.042	1.816
4,4'-DDE	20	20	2.515	1.582	3.126
4,4'-DDT	20	10	0.391	0.287	0.502
Hexachlorobenzene	20	16	0.293	0.286	0.404
Mercury	20	20	1.032	0.602	1.264

NOTE: Concentrations from fish filet samples only were analyzed for inclusion in this table.

FIGURES

38 0820



PROPERTY BOUNDARY EXTENDS FARTHER SOUTH

LEGEND

—x— OLIN PLANT SITE FENCE LINE

▧ OLIN PROPERTY BEYOND PLANT SITE

QUADRANGLE LOCATION

0 (FEET) 2000

SCALE

RE: U.S.G.S. 7.5 MINUTE SERIES QUADRANGLE MAP, McINTOSH, ALABAMA, 1984 AND GINHOUSE ISLAND, ALABAMA, 1984.

RI/FS
McINTOSH PLANT SITE

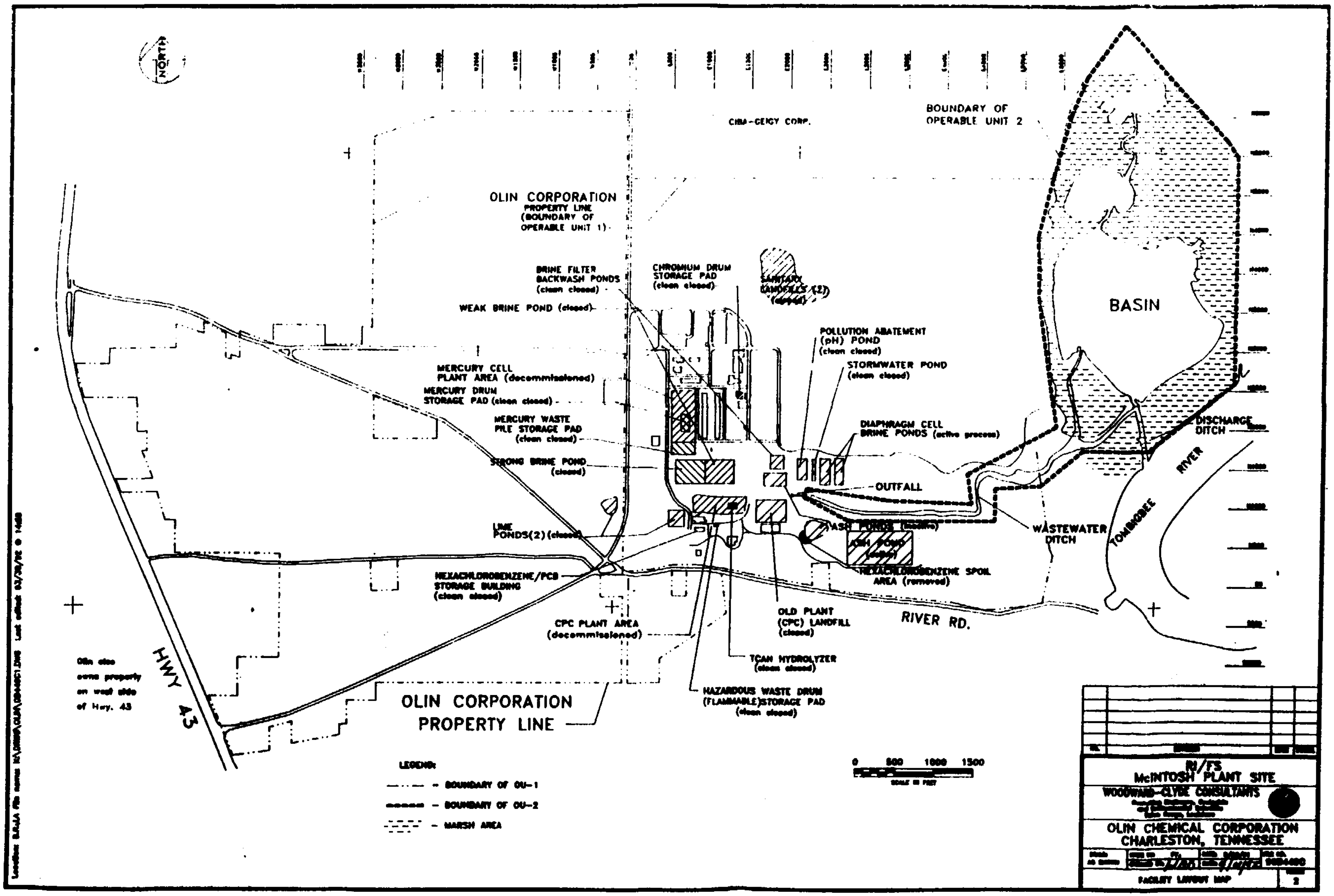
Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists
Baton Rouge, Louisiana

OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE

SCALE: AS SHOWN	MADE BY: DJL	DATE: 10/90	FILE NO. 90B449C
	CHECKED BY: JAS	DATE: 12/90	

SITE LOCATION MAP

FIGURE 1


NORTH
CIBA-GEIGY CORP.
BOUNDARY OF OPERABLE UNIT 2
OLIN CORPORATION PROPERTY LINE (BOUNDARY OF OPERABLE UNIT 1)
BRINE FILTER BACKWASH PONDS (clean closed)
CHROMIUM DRUM STORAGE PAD (clean closed)
SANITARY LANDFILLS (2) (closed)
WEAK BRINE POND (closed)
POLLUTION ABATEMENT (pH) POND (clean closed)
STORMWATER POND (clean closed)
BASIN
MERCURY CELL PLANT AREA (decommissioned)
MERCURY DRUM STORAGE PAD (clean closed)
MERCURY WASTE PILE STORAGE PAD (clean closed)
DIAPHRAGM CELL BRINE PONDS (active process)
DISCHARGE DITCH
STRONG BRINE POND (closed)
OUTFALL
TOMBIGBEE RIVER
LIME PONDS(2) (closed)
WASTEWATER DITCH
HEXACHLOROBENZENE/PCB STORAGE BUILDING (clean closed)
HEXACHLOROBENZENE SPOIL AREA (removed)
OLD PLANT (CPC) LANDFILL (closed)
RIVER RD.
CPC PLANT AREA (decommissioned)
TCAN HYDROLYZER (clean closed)
HAZARDOUS WASTE DRUM (FLAMMABLE) STORAGE PAD (clean closed)
Olin also owns property on west side of Hwy. 43
HWY 43
OLIN CORPORATION PROPERTY LINE
LEGEND:
BOUNDARY OF OU-1
BOUNDARY OF OU-2
MARSH AREA
0 500 1000 1500
SCALE IN FEET
RI/FS
McINTOSH PLANT SITE
WOODWARD-CLYDE CONSULTANTS
OLIN CHEMICAL CORPORATION
CHARLESTON, TENNESSEE
FACILITY LAYOUT MAP
2

3 8 0821

<u>OVERSIZED</u>

<u>DOCUMENT</u>

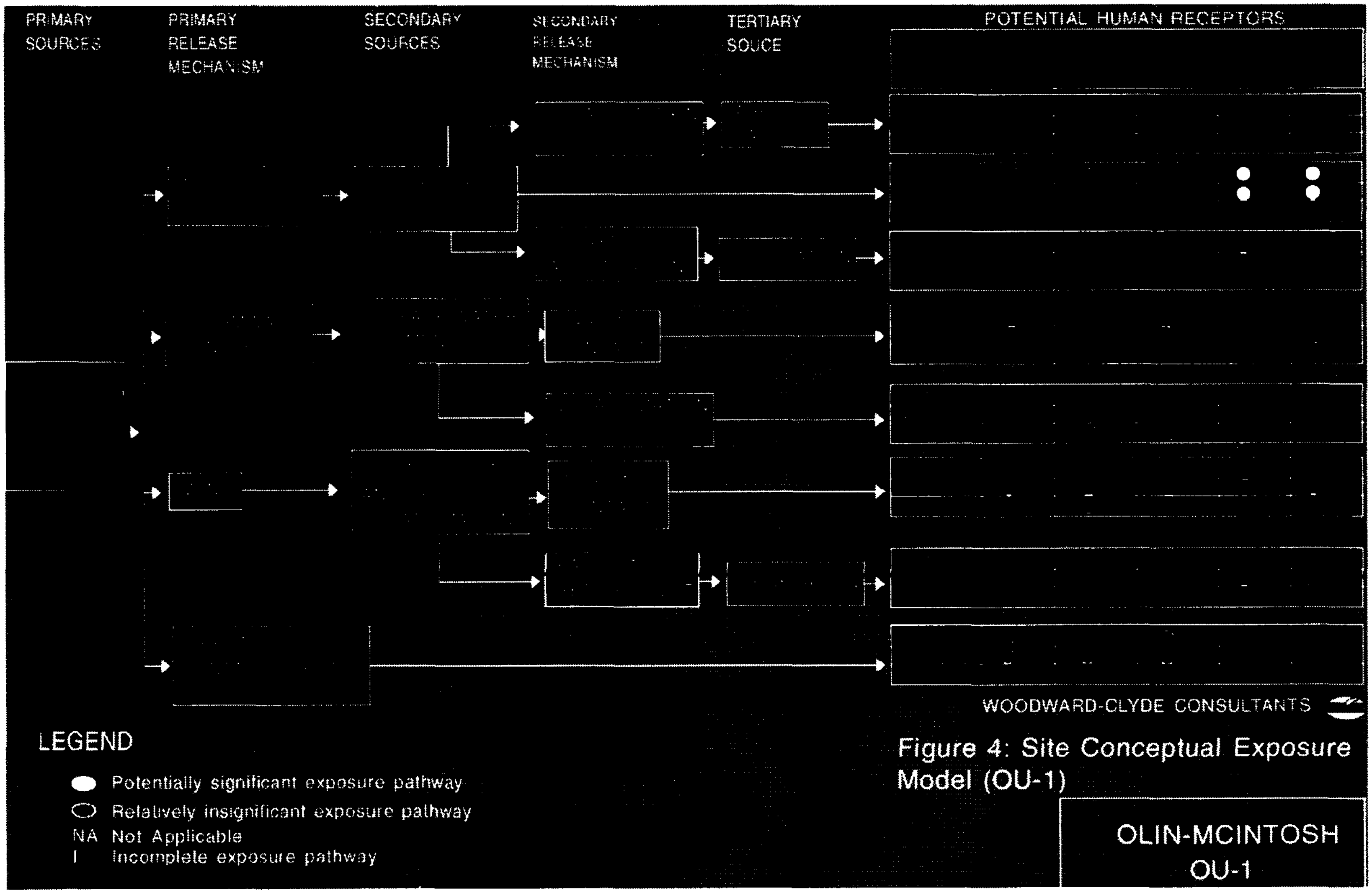
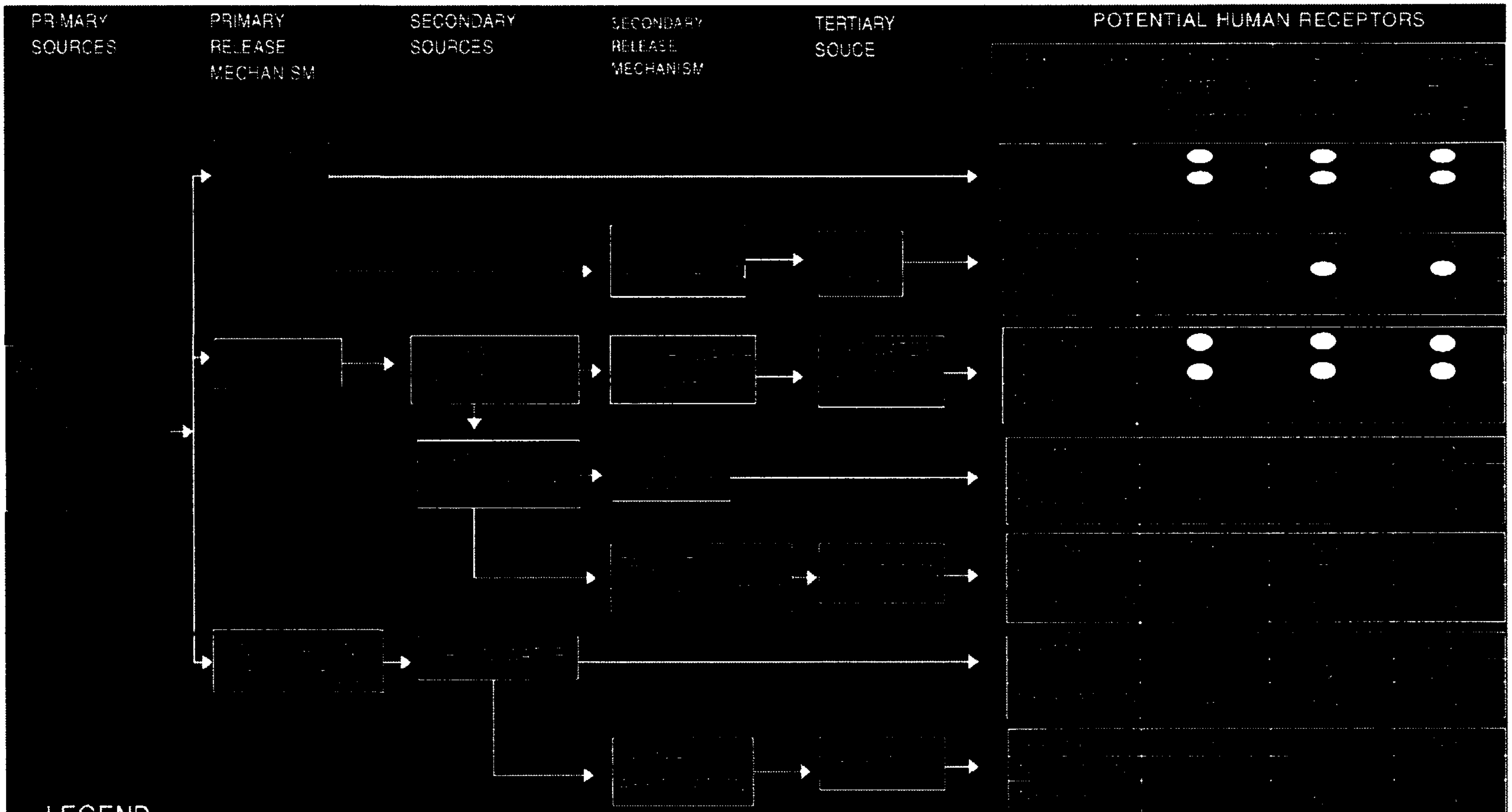


Figure 4: Site Conceptual Exposure Model (OU-1)

38 0823



LEGEND

- ⬬ Potentially significant exposure pathway
- ○ Relatively insignificant exposure pathway
- NA Not Applicable
- I Incomplete exposure pathway

Figure 5:Site Conceptual Exposure Model (OU-2)

WOODWARD-CLYDE CONSULTANTS

OLIN-MCINTOSH
OU-2

3 8 0824

APPENDIX A

LAND USE AND DEMOGRAPHIC ANALYSIS
OF MCINTOSH, ALABAMA

LAND USE AND DEMOGRAPHIC ANALYSIS OF MCINTOSH, ALABAMA

Prepared for:

Olin Chemical Corporation
McIntosh, Alabama

and

WOODWARD-CLYDE, INC.
Baton Rouge, Louisiana

December, 1991

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and
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TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

3 8 0829

1.1 PURPOSE OF THE STUDY

The Olin Corporation, a diversified chemical company, is conducting a Remedial Investigation/Feasibility Study (RI/FS) at its McIntosh, Alabama manufacturing facilitiy. The RI/FS is being conducted under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

The first phase of a RI/FS is the Remedial Investigation (RI), which will fully assess environmental conditions, identify and quantify potential sources of environmental contamination, and identify routes of exposure. Included in the RI is an Endangerment Assessment which will be conducted to evaluate public health risk, if any, associated with the migration of contaminants.

The purpose of this study is to provide information on land use and demographics in the proximity of Olin's McIntosh, Alabama manufacturing facility for use in the Endangerment Assessment.

1.2 DESCRIPTION OF LAND USE ANALYSIS

The land use section of the analysis provides information on the major land uses within a three-mile radius of the Olin facility (hereafter called the Evaluation Area). The analysis includes:

- A description of the existing condition for each land use category,
- The location of domestic water wells,
- The status of the domestic water wells (active, inactive, or closed up),
- Description of the conditions of closed up wells,
- Identification of the depth of the domestic water wells,
- Discussion about how water from active wells is used,
- Identification of primary and secondary source of drinking water,
- Discussion of well diameter and construction materials,
- Discussion of fishing habits of the residents in the Evaluation Area.

A three-mile radius around the Olin facility was chosen as the Evaluation Area because CERCLA guidance documents suggest this as an appropriate distance. This area includes the entire Town of McIntosh, Alabama, the Tombigbee River adjacent to the Olin property, and surrounding rural settlements.

1.3 DESCRIPTION OF DEMOGRAPHIC ANALYSIS

The demographic section of the analysis provides a description of the Evaluation Area population, well-water users population, and the population of Washington County, where the Olin facility is located. The analysis includes:

1.3.1 Evaluation Area

- A discussion of population size,
- A discussion of the age-sex distribution of the population, with emphasis upon potentially vulnerable age groups such as those under 18 or over 65 years of age, and women of child-bearing age,

1.3.2 Well-Water Users

- A discussion of population size,
- A discussion of the age-sex distribution of the population, with emphasis upon potentially vulnerable age groups such as those under 18 or over 65 years of age, and women of child-bearing age,

1.3.3 Washington County

- A discussion of population size,
- A discussion of the age-sex distribution of the population, with emphasis upon potentially vulnerable age groups such as those under 18 or over 65 years of age, and women of child-bearing age,
- A discussion of vital statistics, ethnicity, and marital status, and household types,
- A discussion of the economic characteristics of the population including education levels, income levels, sources of household income, and employment by industry type.

2.0 METHODOLOGY

2.1 LAND USE ANALYSIS

Land use in the Evaluation Area was recorded during on-site or ground observations, personal interviews, and through the use of aerial photographs and topographic maps.

Information about domestic water-wells and fishing were obtained through personal interviews and on-site observations. Attempts were made to interview every household in the Evaluation Area to obtain domestic water-well information. When the householder was not at home, neighbors who were often relatives, were able to provide the needed information. Some households had to be visited a number of times to obtain the necessary information.

Domestic water-well questionnaires were only filled out for those houses with water wells - active, inactive, or closed up. No questionnaires were filled out for houses that did not have a domestic water-well. These houses were soley serviced by the town water system.

2.2 DEMOGRAPHIC ANALYSIS

Data for the demographic analysis were collected from archival records, a private consulting firm, and personal interviews. Demographic and economic data for Washington County were obtained from federal and state government publications, and a personal interview with a state government statistician.

The federal archival sources include the 1980 Census of Population and the 1990 Census of Population. State archival sources include the 1989 Alabama County Data Book and information from the Alabama-Tombigbee Regional Commission. 1990 vital statistics for Washington County were obtained from a personal interview with a statistician from Alabama's Department of Public Health.

Data for the Evaluation Area was purchased from CACI, a marketing research firm in Alexandria, Virginia, which specializes in customized demographic data reports using the latest available census information.

Data for the domestic water-well users were obtained from personal interviews using a questionnaire especially designed for this study. The interviews were carried out by the authors of this report, supported by representatives of Olin Corporation.

3.0 LAND USE ANALYSIS

3.1 LAND USE MAP

A general land use map was prepared of the Evaluation Area. The base map was made from U.S. Geological Survey topographic quadrangles, 7.5 minute series at 1:24,000 and included the Bilbo Island, Calvert, Ginhouse Island, and McIntosh sheets. A three-mile radius circle from a central point in the Olin Corporation plant was drawn to include various activities and locations of private water wells.

Land use was determined by ground observation and from aerial photographs. Maps were updated to include all dwellings having pump wells, active, inactive, and closed up, as determined by personal interviews, and is accurate to the extent that correct information was provided by the inhabitants. All dwellings on the map are depicted in small square symbols and no indication of type or condition is included. Ruined or abandoned dwellings were normally not included.

The land use map depicts seven general categories (Table 3.1). The base map, being a mosaic of four single sheets, includes surface features, such as landforms - shown by contour lines, drainage patterns - streams and swamps, and vegetation depicted by green overprint. Human features are shown in several color patterns and symbols - all within the limits of the 1:24,000 scale, where one inch equals 2,000 feet. The total land area within the three-mile radius circle is 28.274 square miles or 18,095.57 acres.

Table 3.1

EVALUATION AREA LAND USES

Land Use Category	Acres	Square Miles	Percent of Total Area
1. Residential	680	1.063	3.76
2. Commercial	15	0.023	0.08
3. Industrial (Developed Sites)	713	1.114	3.926
4. Recreational	40	0.063	0.221
5. Public Use	45	0.070	0.249
6. Upland Forest	11,686.6	18.26	64.58
7. Floodplains and Swamps	4,916	7.681	27.17
	18,095.6	28.274	99.986

3.2 LAND USE CATEGORIES

The seven land use categories are residential, commercial, industrial, recreational, public use, upland forest, and floodplains and swamps.

3.2.1 Residential

The residential land use includes individual dwellings but more commonly dwellings in groups of two to about twenty. These are organized in several small subdivisions in McIntosh. Beyond the town limits, the pattern is more loosely organized with the orientation much less uniform, e.g., the individual house orientation is not always toward a road or drive, nor always aligned uniformily with adjacent dwellings. Many of the dwellings are very small, with one or two rooms, and many are mobile homes. Frequent changes in location and position occur within neighborhoods. One recent trend is toward more brick veneer "ranch" style houses; landscaping, however, receives much less attention outside of the town limits. Total residential area is approximately 680 acres within the three-mile radius circle. This includes small gardens and scattered houses in which one dwelling is allotted one-half to one acre on the map.

The location of private water wells - now or in the recent past, all electric pumps, are located most often in the rear or at the side of the dwelling within about ten yards. Some are relics of an earlier occupation, i.e., new house, old pump well, often abandoned. Most houses are connected with the town water system entirely; some have pump wells still connected. Some families also share water from electric wells or the town system with their neighbors.

A general ethnic pattern is present in housing locations with most White, generally unmixed population living in McIntosh, the Black population living to the south and southeast of McIntosh, and the Mowa Indians living west along Topton Road and Johnston Road near the edge of the Evaluation Area limits.

3.2.2 Commercial

Commercial activity in and around McIntosh is generally limited to basic domestic needs and services. It is concentrated along Highway 43 at the town center - hardware store, bank, drug store, variety store, and at the junction of Johnston Road and south along the west side of Highway 43 - auto repairs, gas station, convenience stores, eateries, and a post office. Approximately 15 acres are classified as commercial use.

3.2.3 Industrial

Two primary industries, Olin Corporation and Ciba-Geigy Corporation dominate the industrial land uses. Unique to this region is the compressed air power plant, Alabama Electric Cooperative: Compressed Air and Energy Storage, on Highway 43 across from the McIntosh High School. The C&B Cement Company occupies an old drive-in theater site at the extreme southern end of the three-mile radius area on Highway 43.

For chemical manufacturing, Olin and Ciba-Geigy rely on the natural resources of the Tombigbee River water and local natural salt deposits, in addition to other materials brought in. The compressed-air power plant also makes use of open chambers in a salt deposit for compressed air storage underground. The two chemical plant sites cover most of the eastern and central portions of the Evaluation Area comprising approximately 700 acres of the total 3,715 acres of industrial properties.

3.2.4 Recreational

Some recreational areas, such as ball fields, are included under the public use category in school grounds, however, two areas are designated on the map. One is a town park just off River Road and the other is the fishing camp on the Tombigbee River bluff at McIntosh Landing. Other areas may also be similarly classified although they are not clearly defined or structured, such as the area along the north side of Bilbo Creek at the end of Shanty Road, frequently used for fishing. Fishing is a popular sport and a source of supplementary food. Hunting game plots are also scattered through the upland forest. Approximately 40 acres is designated as recreational land use.

3.2.5 Public Use

This category includes town government buildings and the area around the new town hall, post office, public schools, public library, churches, and cemeteries. Public use or (institutional) is approximately 45 acres.

3.2.6 Upland Forest

Forested uplands, above 15 feet elevation, make up the largest category of land use. Much of the forest lands are owned by private and commercial timber companies. Periodically, clear-cutting timber leaves fairly large sections in regenerating forest, mainly pines. A small percentage includes game plots and clearings for pipelines and electrical lines. Approximately 11,687 acres are included in this category of use, or 65 percent of the total area.

3.2.7 Floodplains and Streams

This large category, 27 percent of the total, includes the extensive Tombigbee River floodplain, 4,110 acres, of which approximately 613 acres are normally open water contained in various channels and lakes. The floodplain of Bilbo Creek, about 800 acres, is also included. All land surface area in this category lies below 15 feet elevation above sea level, according to the contour lines on the topographic maps. This natural levees - created by floodwaters are present at this elevation. The U.S. Army Corps of Engineers simply defines the floodplain as that area covered by annual floods. However, this may vary in depth, or elevation reached, from one year to the next.

Poorly drained areas occur all along the Tombigbee River low terrace surface, which includes McIntosh. Even in the town limits, swamps or open water exists, although this apparently has created no serious problems.

3.3 DOMESTIC WATER WELL SURVEY

A questionnaire was developed and personal interviews were conducted to obtain information about domestic water wells, ATTACHMENT C. Information gathered by the domestic water well survey is summarized on the following tables.

3.3.1 Basic Identification and Information

Table 3.3.1 identifies the general location of the active domestic water well by listing its ID NO. which appears on the Domestic Water Well map, its general location by street name, whether or not the well is the primary source of drinking water, and how many people live in the household.

Most of the active domestic water wells are located on the periphery of the Town of McIntosh, especially to the southeast and northeast of town. The active water wells on-site serve as the primary source of drinking water for all but a few who get their drinking water from a domestic water well at another location.

Table 3.3.1

BASIC IDENTIFICATION AND INFORMATION

Well ID	Location	Source of Drinking Water Primary	Source of Drinking Water Secondary	Number in Household
1	Hwy 43	well		2
2	Hwy 43	well		vacant
3	Hwy 43	well		1
4	Hwy 43	well		1
* 5 a	Hwy 43	well		2
b	" "	"		1
c	" "	"		3
6	Hwy 43	well		3
7	Hwy 43	well		vacant
8	Hwy 43	well		4
9	Early Circle	well		2
* 10 a	Early Circle	well		2
b	" "	"		5
11	Topton	well		2
12	Topton	well		4
13	Johnston	city	well	2
14	Peter Adams	well		8
* 15 a	Peter Adams	well # 4		2
b	" "	"		1
16	Peter Adams	well # 4	own well	1
17	Peter Adams	well		2

*	18	Peter Adams	well	4
*	19 a	Peter Adams	well	7
	b	" "	"	2
	20	Peter Adams	well	3
*	21 a	Peter Adams	well	unk
	b	" "	"	unk
	22	Peter Adams	well	7
	23	Peter Adams	well	unk
	24	Marshall Davis	well	4
	25	Marshall Davis	well	5
	26	Wheat	well	unk
	27	River Rd	well	2
	28	Buster Roberts	well	1
	29	Buster Roberts	well	1
	30	Buster Roberts	well	1
	31	Buster Roberts	well	1
	32	Seals	well	6
	33	Hwy 43	city	1
	34	Louella	well	1
*	35 a	Seals	well	4
	b	Seals	well	1
	36	Seals	well	1
*	37 a	Shanty	well	2
	b	"	"	8
	c	"	"	3
	d	"	"	4

* 38 a	Shanty	well	1
b	"	"	3
* 39 a.b	Ray Winn	well	20
40	Watson	city (a friend's house)	1
41	Topton	well	6
** 42(A)	Shanty	well	2
43(A)	Buster Roberts	well	1

* Well used by more than one house.

** Two wells received the same number. the wells with the captial letter A are active wells. while the wells without the A are closed up wells

3.3.2 Complete Well Information

Table 3.3.2.1 serves as a key to Tables 3.3.2.2 and 3.3.2.3 which summarize domestic well information collected through the survey instrument. Table 3.3.2.2 summarizes information for active wells, while Table 3.3.2.3 summarizes information for inactive and closed up wells. For the purposes of this study, active wells are those wells which are used to provide primary or secondary water supplies; inactive wells are wells, which although working, are not used to provide water; and closed up wells are those wells that are closed up with some sort of material, or wells that are not closed up, but have no pump or have a pump in a dilapitated state.

3.3.2.1 Domestic Well Survey Key

Information about each well is number coded in Tables 3.3.2.2 and 3.3.2.3, according to categories of information. The categories of information include: identification number; status of the well; how the well is closed up; how the well water is used; the primary source of drinking water; the depth, diameter, and construction material of the well; and what type of pump the well has. The reliability of this information rests upon the knowledge and cooperation of the inhabitants and the field observations of the interviewers.

Table 3.3.2.1

DOMESTIC WELL SURVEY KEY

1.	ID NO	well identification number (Two ID Nos were used twice: the number with A is an active well)
2.	STATUS	1 active well 2 inactive well. but useable 3 closed up (closed up: no or inoperable pump)
3.	CLOSED UP	1 with dirt 2 with debris 3 capped/metal plug/tin can/well head 4 concrete 5 open pipe 6 back flow valve 7 covered with metal sheet 8 pump not connected to pipe
4.	USE OF WELL WATER	1 drinking 2 water garden 3 bathing 4 wash car 5 wash pets 6 wash livestock 7 wash clothes 8 all of the above
5.	SOURCE OF DRINKING WATER	1 well water 2 town water
6.	DEPTH OF WELL	UK unknown feet
7.	DIAMETER OF WELL	inches
8.	TYPE OF PUMP	1 electric 2 hand 3 electric/hand pump present. but inoperable 4 no pump
9.	MATERIAL	1 PCV pipe 2 galvanized pipe

3.3.2.2 Characteristics of Active Wells

A vast majority of the active domestic water wells were used to provide all of the uses specified in the questionnaire. Only a few households did not use their well as the primary source of water. Some households shared a single well to obtain their primary water supply or obtained their drinking water from an active well located at a different dwelling. These later households are indicated in Tables 3.3.1 and 3.3.2.2. The known depth of the wells ranged from 10 feet to 108, with an average depth of 39 feet.

The diameter of the wells ranged from 1.25 inches to 2 inches, and the pipes were primarily made of galvanized metal. The vast majority of the wells had electric pumps rather than hand pumps.

Table 3.3.2.2

CHARACTERISTICS OF ACTIVE WELLS

ID NO	STATUS	USE(1)	USE(2)	USE(3)	USE(4)	USE(5)	SOURCE	DEPTH	DIAMETER	PUMP	MATERIAL
1	1	8					1	73	2	1	1
2	1	vacent						65	2	1	2
3	1	8					1	UK	2	1	1
4	1	8					1	59	2	1	1
5 a	1	8					1	80	2	1	1
5 b	1	8					1				
5 c	1	8					1				
6	1	8					1	UK	2	1	1
7	1	vacent						UK	2	1	1
8	1	8					1	76	2	1	1
9	1	8					1	19	1.25	1	2
10 a	1	8					1	16	1.25	1	2
10 b	1	8					1				
11	1	8					1	23	1.25	1	2
12	1	8					1	22	1.25	1	2
13	1	1	2				2	18	1.25	1	2
14	1	1	3	4	5		1	UK	1.25	1	1
15 a	1	4	5	7			1	UK	UK	2	2
15 b	1	4	5	7			1				
16	1	1	4	5	7		1	UK	1.25	1	2
17	1	1	2	3	5	7	1	18	1.25	2	2
18	1	8					1	20	1.25	1	2
19 a	1	8					1				
19 b	1	8					1	25	1.25	1	2
20	1	8					1	20	1.25	1	2
21 a	1	8					1	UK	1.25	1	2
21 b	1	8					1				
22	1	8					1	20	1.25	1	2

23		1	8					1	UK	1.25	1	2
24		1	8					1	20	1.5	2	2
25		1	1	2	3	4	7	1	UK	1.5	1	2
26		1	1					1	UK	1.25	1	2
27		1	1					1	28	1.25	2	2
28		1	8					1	75	1.25	1	2
29		1	8					1	70	1.25	1	2
30		1	8					1	70	1.25	1	2
31		1	8					1	70	1.25	1	2
32		1	8					1	25	1.25	1	2
33		1	4					2	UK	1.25	1	2
34		1	1					1	18	2	1	1
35	a	1	8					1	21	1.25	1	2
35	b	1	8					1				
36		1	1					1	10	1.25	1	2
37	a	1	8					1	108	2	1	1
37	b	1	8					1				
37	c	1	8					1				
37	d	1	8					1				
38	a	1	8					1	67	1.5	1	1
38	b	1	8					1				
39	a	1	8					1	28	1.25	1	2
39	b	1	8					1				
40		1	3	7				2	35	1.25	1	2
41		1	8					1	18	1.25	1	2
42	A	1	8					1	60	2	1	1
43	B	1	8					1	UK	2	1	UK

3.3.2.3 Characteristics of Inactive and Closed Up Wells

There were only two wells that were classified as inactive. i.e.. water wells that could be used, but were not being used to supply water. The remaining wells were classified as closed up: some of the wells were not really closed up, but they were not capable of being used in their present condition because they had no pump or the pump was inoperable given its physical condition. The source of drinking water for dwellings classified as inactive or closed up was the town water supply.

The majority of the truly closed up wells were closed up by dirt or some type of cap, such as a metal plug or tin can. Many of the individuals interviewed did not remember or even know the depth of the well on their property. The diameter of a majority of the wells was 2 inches, and the construction material was primarily galvanized metal.

Table 3.3.2.3

CHARACTERISTICS IF INACTIVE AND CLOSED UP WELLS

ID NO	STATUS	CLOSED1	CLOSED2	SOURCE	DEPTH	DIAMETER	PUMP	MATERIAL
42	3	1	2	2	UK	2	4	2
43	3	1		2	UK	UK	UK	UK
44	3	5		2	UK	2	4	2
45	3	3		2	UK	1.25	4	2
46	3	2		2	63	2	4	2
47	3	1		2	UK	UK	UK	UK
48	3	3		2	UK	2	4	2
49	3	UK		2	UK	1.25	3	2
50	3	3		2	20	1.25	4	2
51	3	5		2	UK	1.25	4	2
52	3	UK		2	35	2	3	1
53	3	6		2	UK	2	4	2
54	3	1		2	UK	2	4	2
55	3	3		2	UK	2	4	2
56	3	1		2	UK	1.25	4	2
57	3	7		2	UK	UK	4	UK
58	3	1		2	UK	1.5	4	2
59	3	1		2	UK	1.25	4	2
60	3	3		2	UK	1.5	2	2
61	3	1		2	UK	1.5	2	2
62	3	3		2	32	2	4	2
63	3	1		2	UK	2	4	2
64	3	UK		2	UK	2	3	1
65	3	1		2	UK	1.25	4	2
66	3	UK		2	UK	1.25	3	2
67	3	4		2	20	1.25	4	2
68	3	UK		2	UK	2	3	2
69	3	3		2	UK	2	4	2
70	3	UK		2	UK	1	3	2
71	3	3		2	UK	1	4	2
72	3	3		2	UK	2	4	2
73	3	UK		2	UK	2	3	2
74	3	4		2	46	1.5	4	2
75	3	2		2	UK	2	4	2
76	3	2		2	UK	2	4	2
77	3	UK		2	UK	2	4	1
78	3	2		2	UK	2	4	2
79	3	2		2	UK	2	4	2

80	3	UK		2	40	2	4	2
81	3	UK		2	48	2	3	2
82	2	UK		2	UK	2	3	2
83	3	3		2	53	2.5	4	2
84	2	UK		VACENT	UK	2	3	1
85	3	3		2	30	2	4	2
87	3	3		2	UK	UK	4	2
88	3	UK		2	UK	UK	4	UK
89	3	8		2	UK	1.25	3	2
90	3	UK		2	UK	UK	UK	UK
91	3	UK		2	UK	UK	UK	UK
92	3	UK		2	UK	UK	UK	UK
93	3	1		2	16	1.25	3	2
94	3	5		2	20	UK	UK	UK
95	3	UK		2	UK	2	4	2
96	3	UK		2	UK	2	3	2
97	3	UK		2	UK	UK	4	2
98	3	UK		2	UK	UK	3	UK
99	3	UK		2	UK	1.25	3	2
100	3	3		2	96	2	4	2
101	3	2		2	UK	1.25	4	UK
102	3	5		2	UK	1.24	4	2
103	3	3		2	UK	2	4	UK
104	3	3		2	UK	1.5	3	2
105	3	UK		2	32	1.25	3	2
106	3	UK		2	15	1.25	3	2
107	3	UK		2	UK	1.25	3	2
108	3	5		2	15	1.25	3	2
109	3	3		2	UK	2	4	2
110	3	5		2	14	1.25	4	2
111	3	3		2	28	1.25	4	2
112	3	UK		2	20	1.25	3	2
113	3	UK		2	UK	1.25	3	2
114	2	UK		2	28	UK	2	2
115	3	5		2	UK	UK	4	2
116	3	UK		2	UK	UK	3	2
117	3	3		2	UK	1.25	4	2
118	3	UK		2	15	UK	4	2
119	3	UK	2	2	UK	1.25	3	2

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3.4 FISH SURVEY

Given that the domestic well survey was of the highest priority, far fewer people were asked to respond to the fish survey. Table 3.4.1 and Table 3.4.2 summarize the results of the fish survey.

3.4.1 Fish Survey Key

The identification numbers of the domestic water well questionnaires identify some of the individuals interviewed, while other fish questionnaire respondents do not have an ID number because they did not have a domestic water well (Table 3.4.1). The key identifies the locations where fishing takes place, how often fishing occurs, what kinds of fish are caught, and what is done with the fish once it is caught.

3.4.2 Summary of Fish Survey

The the most popular places to fish are the Tombigbee River and Bilbo Creek (Table 3.4.2). Most people go fishing weekly or monthly. The most commonly caught fish were bass and catfish, and the fishermen stated that they eat what they caught.

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Table 3.4.1

FISHING SURVEY KEY

1.	ID NO	identification number of active, inactive and closed up wells*
2.	WHERE FISH	1 Tombigbee R.
		2 Bates Creek
		3 Watsons Fish Pond
		4 local creeks, ponds
		5 Three Rivers
		6 Bilbo Creek
3.	HOW OFTEN	1 daily
		2 weekly
		3 monthly
		4 biweekly
		5 occasionaly
4.	KIND of FISH CAUGHT	1 bass
		2 crappie
		3 catfish
		4 bluegill
		5 brim
		6 jack
		7 white perch
5.	WHAT DO YOU DO WITH FISH	1 eat it
		2 give it away
		3 sell it
6.	IF EAT FISH CAUGHT, HOW OFTEN	1 daily
		2 weekly
		3 monthly
		4 biweekly
		5 occasionly

* Individuals without wells (active, inactive, closed up) were not given an ID NOs.

Table 3.4.2

SUMMARY OF FISH SURVEY

ID NO	WHERE1	WHERE2	WHERE3	OFTEN	KIND1	KIND2	KIND3	DOWITH1	DOWITH2	EAT
5 a	1			3	1	2	3	1		3
5 b	1			2	3	2	4	UK		UK
5 c	1			3	3	4	2	1	2	3
8	1			3	3	4	2	1		3
10 a	2			3	1	4		1		3
10 b	3			4	3			1		4
11	1			1	3	4	1	1	1	1
13	UK			3	4			1		3
28	1			5	3	1	5	1		5
34	4			1	3			1	2	1
35	1	5		5	5	3	6	1		5
37	6			3	5	3		UK		UK
38 a	6			3	5	3		1		3
38 b	6			3	UK			UK		UK
39	6			2	5	3		1		2
42	6			1	5	3	7	1		1
46	1			2	3	4	1	1		2
47	1			5	3			1		5
51	UK			2	UK			1	2	2
67	1			5	5			1	2	5
96	1			5	1	3	5	UK		UK
	1			3	5	3		1	2	2
	1	5	6	5	1	3	5	1		UK
	1			5	UK			UK	1	5
	UK			2	1	3	4	1	2	2
	UK			2	1	3	4	1		2
	1			3	1	4	2	1		3
	1			2	1	2	3	1	2	2
	1			2	1	2	3	1		2
	1			2	1	2	3	1		2
	UK			2	UK			1		1
	UK			5	3	4		1		5
	1			1	1	2	3	1		3
	1			5	1	2	3	1		5
	6			3	1	4		1		3
	1			5	1	2	3	1		3
	5			1	3	5		1	2	1

4.0 DEMOGRAPHIC ANALYSIS

4.1 INTRODUCTION

The Demographic Analysis is divided into three sections: Evaluation Area, well-water users, and Washington County.

4.2 Evaluation Area

This section discusses the population size and age-sex characteristics of the Evaluation Area.

4.2.1 Population Size

According to the 1990 Census, population size of the Evaluation Area was 1558. (CACI). This population size may be an undercount according to Mr. Jarrell, Statistician, Office of Vital Statistics, Department of Public Health, Montgomery, AL. Mr. Jarrell indicated in a personal interview that is was highly likely that the population size of Washington County was under-counted by the 1990 Census of Population.

4.2.2 Age-Sex Structure

The age-sex structure of the Evaluation Area indicates that infant and school age children, 0 - 18 years of age, made-up 34.5 percent of the Evaluation Area's population, while the population aged 65 years and older accounted for 8.8 percent of the population (Table 4.2.2) (CACI). 24.2 percent of the Evaluation Area's population was female, aged 14 to 44, which represents the major child-bearing age range.

Table 4.2.2

AGE-SEX CHARACTERISTICS OF THE EVALUATION AREA

	% of Total Population	
Age	Male	Female
0-4	5.1	3.8
5-9	5.5	4.9
10-14	4.9	4.8
15-19	4.8	4.4
20-24	3.4	4.4
25-29	4.2	3.3
30-34	3.6	3.5
35-39	3.4	3.9
40-44	2.9	3.6
45-49	2.6	2.4
50-54	2.2	2.2
55-59	1.6	2.1
60-64	1.7	1.8
65-69	1.5	1.5
70-74	1.2	1.2
75-79	0.97	0.97
80-84	0.32	0.39
85+	0.06	0.04
Median Age	26.6	29.0

4.3 WELL-WATER USERS

This section discusses the population size and age-sex characteristics of the well-water users. The reliablity of the data are a function of the cooperation of local residents in answering questions during the domestic well survey.

4.3.1 Population Size

The population size of the well-water users was approximately 151. 84 females and 67 males.

4.3.2 Age-Sex Characteristics

Over 37% of the population were aged 0 to 18, while 12.3 percent of the population were aged 65 years and older (Table 4.3.2). Females, aged 14 to 44, accounted for 22.0 percent of the well-water users' population.

Table 4.3.2

AGE-SEX CHARACTERISTICS OF WELL-WATER USERS

% of Total Population

Age	Male	Female
0-4	4.1	2.7
5-9	4.7	6.1
10-14	6.1	9.5
15-19	4.1	2.7
20-24	1.4	4.7
25-29	3.4	2.7
30-34	3.4	4.1
35-39	2.7	2.0
40-44	2.7	2.7
45-49	2.7	3.4
50-54	2.7	2.7
55-59	0.7	1.4
60-64	3.4	2.7
65-69	0.0	2.7
70-74	1.4	2.0
74-79	0.7	1.4
80-84	0.7	2.0
85+	0.0	1.4

4.4. WASHINGTON COUNTY

This section discusses demographic and economic data for Washington County. The U.S. Census Bureau has released population and housing data from the 1990 Census of Population. The Bureau has, however, not released economic data, hence 1980 census data had to be used in some of this analysis.

4.4.1 Population Size

The population size of Washington County was 16,694, a decline of 127 persons from 1980 (CACI). This decline runs counter to population projections of a 7% increase between 1980 and 1990 (Alabama County Data Book, 1989).

4.4.2 Age-Sex Characteristics

Almost 32 percent of Washington County's population was aged 0 to 18, while individuals 65 years and older constituted 12 percent of the county's population (Table 4.4.2) (CACI). Females, aged 14 to 44, accounted for 23.2 percent of the County's population.

The Evaluation Area had a slightly higher percentage of persons aged 0 - 18 and females aged 14 to 44 than Washington County, while Washington County had a slightly higher percentaage of persons 65 years of age and older. The median age of both females and males was higher in Washington County than in the Evaluation Area.

TABLE 4.4.2

AGE-SEX CHARACTERISTICS OF WASHINGTON COUNTY

% Total Population

Age	Male	Female
0-4	3.9	3.4
5-9	4.5	4.4
10-14	4.6	4.2
15-19	4.4	4.2
20-24	3.8	3.5
25-29	3.5	3.7
30-34	3.9	3.9
35-39	3.2	3.8
40-44	3.3	3.2
45-49	2.8	2.9
50-54	2.3	2.4
55-59	2.2	2.3
60-64	1.9	2.1
65-69	1.7	2.0
70-74	1.4	1.7
75-79	1.0	1.6
80-84	0.59	0.98
85+	0.37	0.78
Median Age	30.3	32.7

4.4.3 Vital Statistics

The crude birth and crude death rates of Washington County, while fluctuating slightly for the past several years, have resulted in a positive rate of natural increase (Table 4.4.3).

Table 4.4.3

VITAL STATISTICS

	1988 (1)	1989 (2)	1990 (2)
Crude Birth Rate	15.60	13.80	17.30
Crude Death Rate	8.70	9.60	10.40
Rate of Natural Increase (%)	0.69	0.42	0.69

1 Alabama County Data Book, 1989
2 Personal conversation with Mr. William Jarrell, Statistican, Office of Vital Records, Center for Health Statistics, Alabama, Department of Public Health, Montgomery, Al.

Mr. Jarrell indicated that the crude birth and crude death rates for 1990 are artifically high because the total population size of the county was undercounted by the 1990 Census.

The positive rate of natural increase indicates that Washington County's population is increasing naturally, albeit slowly. The County's population size is, however, declining. This decline is do to a negative migration rate of - 4.2%. Between 1980 and 1988, 700 more people migrated out of Washington County than migrated into Washington County. (Alabama County Data Book, 1989).

4.4.4 Ethnicity

Washington County's population was over 65 percent White, with a Black population of 27.7 percent, and an American Indian population of 6.4 percent (Table 4.4.4) (CACI). This differs from the ethnicity profile of the Evaluation Area, which was predominately Black.

Table 4.4.4

ETHNICITY

	Evaluation Area	Washington County
	% of Total Population	% of Total Population
White	21.6	65.8
Black	64.0	27.7
Am. Indian	14.2	6.4

4.4.5 Marital Status

The population of Washington County had a higher percentage of married persons than the Evaluation Area, which had lower percentages of separated and divorced persons (Table 4.4.5) (CACI).

Table 4.4.5

MARTIAL STATUS

	Evaluation Area	Washington County
	% of Total Population	% of Total Population
Marital Status		
Never Married	29.5	22.4
Now Married, except Separated	52.5	60.7
Separated	3.4	1.8
Widowed	7.5	8.9
Divorced	7.0	6.2

4.4.6 Household Type

More than 79 percent of the households in Washington County were family households (1990 Census of Population and Housing) (Table 4.4.6). A majority of these households were married couples. There was a larger percentage of households headed by female householders than male householders. About 19 percent of the households were persons living alone.

Table 4.4.6

HOUSEHOLD TYPES

Household Types	Total Number	% of Total Households
Family Households	4548	79.7
Married couples	3648	63.9
Male Householders	175	3.1
Female Householders	725	12.7
Nonfamily Households	1161	20.3
Living Alone	1096	19.2
More Than One person	65	1.1
Persons per Household	2.91	

4.4.7 Education

The education levels of Washington County's population was based upon the 1980 Census (Table 4.4.7) (CACI). The results of the 1990 Census will not be available until late Spring/Summer. 1992. 53.6 percent of the County's population had less than four years of high school. while 33.8 percent had graduated from high school. and 12.7 percent had attended college. Overall. the educational levels for the County had improved since the 1970's. (Overall Economic Development Program. 1985). and there is every reason to believe that this improvement continued on into the 1980's.

Table 4.4.7

EDUCATIONAL LEVELS*

Education Completed	Total Number	Percent of Total
Elementary School	3040	33.9
Some High School	1763	19.7
High School Graduate	3030	33.8
Some College	643	7.2
College Graduate	489	5.5
Median School Years	11.4	

*For persons 25 years of age and older.

4.4.8 Income

Detailed income statistics are not yet available from the 1990 Census. The expected date of release is late Spring/Summer, 1992. The following income figures were provided by CACI, and are based upon projections made with 1980 Census data (Table 4.4.8).

Table 4.4.8

INCOME LEVELS

Income Levels	1980 Census	1990 Update	1995 Forecast	Annual Growth
Total Income (Mil$)	78.5	139.4	151.7	1.7%
Per Capita $	4668	8053	8705	1.6%
Average Family Income $	16734	26155	26983	0.6%
Median Family Income $	15604	24401	24854	0.4%
Average Hhld Income $	14894	23351	24067	0.6%
Median Hhld Income $	12797	20600	20977	0.4%

4.4.9 Sources of Household Income

Detailed income statistics are not yet available from the 1990 Census. The following information is from the 1980 Census (1980 Census of Population, General Social and Economic Characteristics) (Table 4.4.9). The major sources of household income for Washington County were wages and salaries, followed by social security, interest/dividend/rent, and public assistance.

Table 4.4.9

SOURCES OF HOUSEHOLD INCOME

Income Source	No. of Households	% of Households
Wage or Salary	3829	72.2
Nonfarm Self-Employed	477	8.9
Farm Self-Employed	325	6.1
Interest/Dividend/Rent	1046	19.7
Social Security	1643	30.9
Public Assistance	897	16.9
Other	1200	22.6

4.4.10 Employment by Industry Type

These data are not yet available for the 1990 Census. The following information is from the 1980 Census (1980 Census of Population, General Social and Economic Characteristics) (Table 4.4.10).

Table 4.4.10

EMPLOYMENT BY INDUSTRY TYPE

Industry Type	Total Number	Percent of Total
Agriculture	150	2.7
Construction	455	8.1
Manufacturing	2452	43.6
Transportation	395	7.0
Communication	6	0.1
Wholesale	156	2.8
Retail	516	9.2
Finance	105	1.9
Service	1080	19.2
Health	323	5.7
Education	405	7.2
Other Services	233	4.1
Government	200	3.6

Washington County's population was primarily employed in manufacturing and service. Given changes in national, regional, and state sources of personal income, it is likely that Washington County's 1990 data will show an increase in service employment and a decrease in manufacturing employment (State Personal Income 1929-1987: Estimates and Statements of Sources and Methods).

The major employers in the Evaluation Area are Olin Chemical Corporation and Ciba-Geigy Chemical Corporation. Local merchants, professionals, local government, and the local school system also employ people within the Evaluation Area.

5.0 SOURCES

Alabama County Data Book, 1989. 14th. ed., Alabama Department of Economic and Community Affairs, Planning and Economic Development Division. Montgomery, AL. July, 1990.

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Overall Economic Development Program (revised), 1985. Alabama-Tombigbee Regional Commission, Camden, AL, 1985.

U.S. Bureau of the Census. *1980 Census of Population*. Vol 1. *Characteristics of Population, Chapter C, General Social and Economic Characteristics, Alabama*. PC80-1-C-2. June, 1983.

U.S. Bureau of the Census. *1990 Census of Population. Characteristics of Population and Housing*. 1991.

U.S. Department of Commerce, Bureau of Economic Analysis. *State Personal Income, 1929-1987: Estimates and a Statement of Sources and Methods*. Washington, DC: U.S. Government Printing Office, July, 1989.

ATTACHMENT C: Domestic Well Survey

DATE: ____________
INTERVIEWER: ________

3 8 0860 32

BASIC INTRODUCTION

Hello! We are conducting a survey in the McIntosh area.

Do you have a water well or pump on your property?
Probe: currently have, did have....

If you don't have a well/pump, do you use a relative's or neighbor's well/pump?

Do you fish in the area?

WELL QUESTIONNAIRE

Address of well location ________________________________

Well I.D. number ____________

1. Status of water well:

___ active (using) ___ inactive (not using) ___ closed up

2. If well is closed up how:

___ filled with dirt ___ filled with concrete

___ filled with debris ___ dry

___ capped ___ other (____________________)

IF Q2 IS ANSWERED, SKIP TO Q4

3. How do you use your well?

___ drinking ____ bathing ___ washing car

___ watering garden ___ watering pets ___ watering livestock

___ other (__________________)

4. Source of drinking water?

well or pump all ____ some (%) ________

city service all ____ some (%) ________

other (________________) all ____ some (%) ________

5. What is the depth of your well? ____________
** whether used or not **

6. Description of well:

well diameter _____ electric pump ____ hand pump ____

construction materials ____

____

location at site ____

IF THE SUBECT DOESN'T FISH GO TO THE HOUSEHOLD QUESTION.

FISH QUESTIONNAIRE

1. Do you or any member of your household fish? ___ no ___ yes
2. If yes, where? ___ Tombigbee R.

   ____ other (______________________________________)
3. How often do you fish? ____ daily ___ weekly ___ monthly

   ___ other (____________________)
4. What kind of fish do you catch? ______________________

   _______________, ______________________, ___________________
5. What do you do with the fish that you catch? ___ eat it

   ___ give it away ___ sell it ____ other (________________)
6. If subject eats the fish that is caught, how often?

   ___ daily ___ weekly ___ monthly ___ other (_____________)

HOUSEHOLD QUESTION: The age and sex of individuals who permanently live in the household.

	Age	Sex		Age	Sex
Person 1	_______	F M	Person 6	_______	F M
Person 2	_______	F M	Person 7	_______	F M
Person 3	_______	F M	Person 8	_______	F M
Person 4	_______	F M	Person 9	_______	F M
Person 5	_______	F M	Person 10	_______	F M

OVERSIZED

DOCUMENT

APPENDIX B

DOMESTIC WELL, SURFACE WATER, SEDIMENT AND FISH DATA USED FOR EXPOSURE ASSESSMENT

PARAMETER	SAMPLE ID	DETECT?	CONC	DET LIM	(N) TOTAL RECORDS	($\bar{X}$) MEAN	ST.DEV.	S.E.M.	B	95% UPPER CONF. LIMIT OF MEAN
4,4'-DDD	CC-G1-41-FI	Y	0.41		20	1.4135	1.042791	0.233175	1.729	1.81666
4,4'-DDD	CC-G2-38-FI	Y	1.2							
4,4'-DDD	CC-G2-39-FI	Y	2.6							
4,4'-DDD	CC-G2-40-FI	Y	1.5							
4,4'-DDD	CC-G3-10-FI	Y	0.69							
4,4'-DDD	CC-G3-12-FI	Y	3							
4,4'-DDD	CC-G3-14-FI	Y	1							
4,4'-DDD	CC-G3-16-FI	Y	0.33							
4,4'-DDD	CC-G3-18-FI	Y	0.64							
4,4'-DDD	CC-G3-20-FI	Y	0.59							
4,4'-DDD	LB-E2-05-FI	Y	2.6							
4,4'-DDD	LB-E2-06-FI	Y	1.2							
4,4'-DDD	LB-E3-22-FI	Y	0.81							
4,4'-DDD	LB-E3-24-FI	Y	1.3							
4,4'-DDD	LB-E4-26-FI	Y	1.7							
4,4'-DDD	LB-E5-29-FI	Y	3.1							
4,4'-DDD	LB-E5-31-FI	Y	3.8							
4,4'-DDD	LB-E6-33-FI	Y	0.54							
4,4'-DDD	LB-E6-35-FI	Y	0.84							
4,4'-DDD	LB-E6-36-FI	Y	0.42							
4,4'-DDE	CC-G1-41-FI	Y	0.67		20	2.515	1.582591	0.353878	1.729	3.126855
4,4'-DDE	CC-G2-38-FI	Y	2.2							
4,4'-DDE	CC-G2-39-FI	Y	3.8							
4,4'-DDE	CC-G2-40-FI	Y	2.3							
4,4'-DDE	CC-G3-10-FI	Y	1.3							
4,4'-DDE	CC-G3-12-FI	Y	5.9							
4,4'-DDE	CC-G3-14-FI	Y	2.1							
4,4'-DDE	CC-G3-16-FI	Y	0.85							
4,4'-DDE	CC-G3-18-FI	Y	1.4							
4,4'-DDE	CC-G3-20-FI	Y	1.6							
4,4'-DDE	LB-E2-05-FI	Y	3.9							
4,4'-DDE	LB-E2-06-FI	Y	2							
4,4'-DDE	LB-E3-22-FI	Y	1.7							
4,4'-DDE	LB-E3-24-FI	Y	2.6							
4,4'-DDE	LB-E4-26-FI	Y	3.2							
4,4'-DDE	LB-E5-29-FI	Y	4.9							
4,4'-DDE	LB-E5-31-FI	Y	5.8							
4,4'-DDE	LB-E6-33-FI	Y	1.1							
4,4'-DDE	LB-E6-35-FI	Y	2							
4,4'-DDE	LB-E6-36-FI	Y	0.98							
4,4'-DDT	CC-G1-41-FI		0.460	0.920	20	0.3916	0.287019	0.064179	1.729	0.502566
4,4'-DDT	CC-G2-38-FI	Y	0.170							
4,4'-DDT	CC-G2-39-FI	Y	0.240							
4,4'-DDT	CC-G2-40-FI	Y	0.200							
4,4'-DDT	CC-G3-10-FI		0.330	0.660						
4,4'-DDT	CC-G3-12-FI	Y	0.360							
4,4'-DDT	CC-G3-14-FI		0.330	0.660						
4,4'-DDT	CC-G3-16-FI		0.470	0.940						
4,4'-DDT	CC-G3-18-FI		0.850	1.700						
4,4'-DDT	CC-G3-20-FI		1.400	2.800						
4,4'-DDT	LB-E2-05-FI	Y	0.430							
4,4'-DDT	LB-E2-06-FI	Y	0.160							
4,4'-DDT	LB-E3-22-FI		0.330	0.660						
4,4'-DDT	LB-E3-24-FI	Y	0.082							
4,4'-DDT	LB-E4-26-FI	Y	0.200							
4,4'-DDT	LB-E5-29-FI	Y	0.470							
4,4'-DDT	LB-E5-31-FI	Y	0.360							

38 0864

4,4'-DDT	LB-E6-33-FI		0.330	0.660						
4,4'-DDT	LB-E6-35-FI		0.330	0.660						
4,4'-DDT	LB-E6-36-FI		0.330	0.660						
HEXACHLOROBENZENE	CC-G1-41-FI		0.46	0.92	20	0.2935	0.286361	0.064032	1.729	0.404212
HEXACHLOROBENZENE	CC-G2-38-FI	Y	0.31							
HEXACHLOROBENZENE	CC-G2-39-FI		0.33	0.66						
HEXACHLOROBENZENE	CC-G2-40-FI	Y	0.25							
HEXACHLOROBENZENE	CC-G3-10-FI	Y	0.22							
HEXACHLOROBENZENE	CC-G3-12-FI	Y	0.58							
HEXACHLOROBENZENE	CC-G3-14-FI	Y	0.25							
HEXACHLOROBENZENE	CC-G3-16-FI	Y	0.18							
HEXACHLOROBENZENE	CC-G3-18-FI	Y	0.2							
HEXACHLOROBENZENE	CC-G3-20-FI		1.4	2.8						
HEXACHLOROBENZENE	LB-E2-05-FI	Y	0.18							
HEXACHLOROBENZENE	LB-E2-06-FI	Y	0.12							
HEXACHLOROBENZENE	LB-E3-22-FI	Y	0.13							
HEXACHLOROBENZENE	LB-E3-24-FI	Y	0.14							
HEXACHLOROBENZENE	LB-E4-26-FI	Y	0.12							
HEXACHLOROBENZENE	LB-E5-29-FI	Y	0.19							
HEXACHLOROBENZENE	LB-E5-31-FI	Y	0.2							
HEXACHLOROBENZENE	LB-E6-33-FI	Y	0.15							
HEXACHLOROBENZENE	LB-E6-35-FI	Y	0.13							
HEXACHLOROBENZENE	LB-E6-36-FI		0.33	0.66						
MERCURY	CC-G1-41-FI	Y	0.62		20	1.032	0.602046	0.134621	1.729	1.264761
MERCURY	CC-G2-38-FI	Y	0.57							
MERCURY	CC-G2-39-FI	Y	0.63							
MERCURY	CC-G2-40-FI	Y	0.57							
MERCURY	CC-G3-10-FI	Y	0.29							
MERCURY	CC-G3-12-FI	Y	0.28							
MERCURY	CC-G3-14-FI	Y	0.67							
MERCURY	CC-G3-16-FI	Y	0.39							
MERCURY	CC-G3-18-FI	Y	0.52							
MERCURY	CC-G3-20-FI	Y	0.61							
MERCURY	LB-E2-05-FI	Y	1.5							
MERCURY	LB-E2-06-FI	Y	1.8							
MERCURY	LB-E3-22-FI	Y	1.4							
MERCURY	LB-E3-24-FI	Y	2.2							
MERCURY	LB-E4-26-FI	Y	1.7							
MERCURY	LB-E5-29-FI	Y	1.7							
MERCURY	LB-E5-31-FI	Y	1.8							
MERCURY	LB-E6-33-FI	Y	0.9							
MERCURY	LB-E6-35-FI	Y	1.5							
MERCURY	LB-E6-36-FI	Y	0.99							

SEM = STANDARD ERROR MEASUREMENT
B = BETA

38 0865

PARAMETER	SAMPLE ID	DETECT?	CONC	DET LIM	CRQL/ CRDL	TOTAL RECORDS	MEAN	ST DEV	S.E.M.	B	95% UPPER CONF. LIM OF MEAN
ARSENIC	SCC102	Y	4.3			27	6.085185	3.526897	0.678752	1.706	7.243136
ARSENIC	SCC104	Y	4.6								
ARSENIC	SCC202	Y	2.5								
ARSENIC	SCC204	Y	2.2								
ARSENIC	SCC302	Y	4.2								
ARSENIC	SCC304	Y	3.3								
ARSENIC	SGBD05	Y	4.1								
ARSENIC	SGBD06	Y	3.2								
ARSENIC	SGC05	Y	2.1								
ARSENIC	SGC06	Y	6.7								
ARSENIC	SGC10	Y	8.3								
ARSENIC	SGD06	Y	7.3								
ARSENIC	SGD10	Y	8.4								
ARSENIC	SGDD01	Y	16.1								
ARSENIC	SGF07	Y	7.4								
ARSENIC	SGG03	Y	3.4								
ARSENIC	SGG08	Y	6.9								
ARSENIC	SGG09	Y	7.1								
ARSENIC	SGH04	Y	6.5								
ARSENIC	SGH08	Y	8.1								
ARSENIC	SGI10	Y	14.7								
ARSENIC	SGJ06	Y	10.1								
ARSENIC	SGJ07	Y	7.6								
ARSENIC	SGK04	Y	3.7								
ARSENIC	SGOD06	Y	4.8								
ARSENIC	SGOD17	Y	1.3								
ARSENIC	SGOD20	Y	5.4								
BENZENE	SCC102		0.0115	0.0230		39	0.117346	0.384392	0.061552	1.686	0.221123
BENZENE	SCC104		0.0100	0.0200							
BENZENE	SCC202	Y	0.0400								
BENZENE	SCC204	Y	0.1800								
BENZENE	SCC206	Y	0.0050								
BENZENE	SCC207		0.0080	0.0160							
BENZENE	SCC208		0.0070	0.0140							
BENZENE	SCC302		0.0070	0.0140							
BENZENE	SCC304	Y	0.0300								
BENZENE	SCE204		1.1000	2.2000							
BENZENE	SCE205	Y	0.0100								
BENZENE	SCE206		0.0080	0.0160							
BENZENE	SCI704		0.0095	0.0190							
BENZENE	SCI705		0.0065	0.0130							
BENZENE	SCOD152	Y	0.7000								
BENZENE	SCOD153	Y	2.1000								
BENZENE	SCOD252		0.0065	0.0130							
BENZENE	SCOD253		0.0060	0.0120							
BENZENE	SGBD05		0.0145	0.0290							
BENZENE	SGBD06		0.0120	0.0240							
BENZENE	SGC05		0.0065	0.0130							
BENZENE	SGC06		0.0190	0.0380							
BENZENE	SGC10		0.0230	0.0460							
BENZENE	SGD06		0.0255	0.0510							
BENZENE	SGD10		0.0225	0.0450							
BENZENE	SGDD01		0.0105	0.0210							
BENZENE	SGF07		0.0210	0.0420							
BENZENE	SGG03		0.0110	0.0220							
BENZENE	SGG08		0.0205	0.0410							
BENZENE	SGG09		0.0210	0.0420							
BENZENE	SGH04		0.0150	0.0300							

3 8 0866

BENZENE	SGH08		0.0230	0.0460							
BENZENE	SGI10		0.0210	0.0420							
BENZENE	SGJ06		0.0240	0.0480							
BENZENE	SGJ07		0.0115	0.0230							
BENZENE	SGK04		0.0100	0.0200							
BENZENE	SGOD06		0.0075	0.0150							
BENZENE	SGOD17		0.0060	0.0120							
BENZENE	SGOD20		0.0065	0.0130							
CHROMIUM	SCC102	Y	55.4			27	32.65185	14.65987	2.821294	1.706	37.46498
CHROMIUM	SCC104	Y	69.4								
CHROMIUM	SCC202	Y	28.3								
CHROMIUM	SCC204	Y	22.5								
CHROMIUM	SCC302	Y	27.1								
CHROMIUM	SCC304	Y	35.2								
CHROMIUM	SGBD05	Y	39.2								
CHROMIUM	SGBD06	Y	18.5								
CHROMIUM	SGC05	Y	6.1								
CHROMIUM	SGC06	Y	26.8								
CHROMIUM	SGC10	Y	35.9								
CHROMIUM	SGD06	Y	33.3								
CHROMIUM	SGD10	Y	43.2								
CHROMIUM	SGDD01	Y	26.7								
CHROMIUM	SGF07	Y	37.1								
CHROMIUM	SGG03	Y	21.3								
CHROMIUM	SGG08	Y	41								
CHROMIUM	SGG09	Y	29.5								
CHROMIUM	SGH04	Y	44.6								
CHROMIUM	SGH08	Y	42.2								
CHROMIUM	SGI10	Y	52.1								
CHROMIUM	SGJ06	Y	51.9								
CHROMIUM	SGJ07	Y	18.8								
CHROMIUM	SGK04	Y	30.8								
CHROMIUM	SGOD06	Y	21								
CHROMIUM	SGOD17	Y	9.3								
CHROMIUM	SGOD20	Y	14.4								
HEXACHLOROBENZENE	SCC102		0.375	0.75	0.33	47	56.73638	158.1476	23.0682	1.679	95.46788
HEXACHLOROBENZENE	SCC104		0.325	0.65	0.33						
HEXACHLOROBENZENE	SCC201		0.28	0.56	0.33						
HEXACHLOROBENZENE	SCC202		0.27	0.54	0.33						
HEXACHLOROBENZENE	SCC202		0.295	0.59	0.33						
HEXACHLOROBENZENE	SCC203		0.23	0.46	0.33						
HEXACHLOROBENZENE	SCC204		0.275	0.55	0.33						
HEXACHLOROBENZENE	SCC302	Y	2.8		0.33						
HEXACHLOROBENZENE	SCC304		0.285	0.57	0.33						
HEXACHLOROBENZENE	SCE201	Y	250		0.33						
HEXACHLOROBENZENE	SCE202	Y	72		0.33						
HEXACHLOROBENZENE	SCE203	Y	70		0.33						
HEXACHLOROBENZENE	SCE204	Y	2		0.33						
HEXACHLOROBENZENE	SCE205		0.265	0.53	0.33						
HEXACHLOROBENZENE	SCE206		0.265	0.53	0.33						
HEXACHLOROBENZENE	SCI701	Y	0.39		0.33						
HEXACHLOROBENZENE	SCI702		0.55	1.1	0.33						
HEXACHLOROBENZENE	SCI703	Y	0.34		0.33						
HEXACHLOROBENZENE	SCI704		0.31	0.62	0.33						
HEXACHLOROBENZENE	SCI705		0.21	0.42	0.33						
HEXACHLOROBENZENE	SCOD151	Y	480		0.33						
HEXACHLOROBENZENE	SCOD152	Y	130		0.33						
HEXACHLOROBENZENE	SCOD153	Y	560		0.33						
HEXACHLOROBENZENE	SCOD251	Y	51		0.33						
HEXACHLOROBENZENE	SCOD252	Y	45		0.33						
HEXACHLOROBENZENE	SCOD253	Y	2.3		0.33						
HEXACHLOROBENZENE	SGBD05	Y	0.73		0.33						
HEXACHLOROBENZENE	SGBD06	Y	4.5		0.33						
HEXACHLOROBENZENE	SGC05	Y	20		0.33						

HEXACHLOROBENZE	SGC06		0.65	1.3	0.3						
HEXACHLOROBENZE	SGC10		0.75	1.5	0.3						
HEXACHLOROBENZENE	SGD06		0.85	1.7	0.33						
HEXACHLOROBENZENE	SGD10		0.75	1.5	0.33						
HEXACHLOROBENZENE	SGDD01	Y	26		0.33						
HEXACHLOROBENZENE	SGF07		0.7	1.4	0.33						
HEXACHLOROBENZENE	SGG03	Y	40		0.33						
HEXACHLOROBENZENE	SGG08		0.65	1.3	0.33						
HEXACHLOROBENZENE	SGG09		0.7	1.4	0.33						
HEXACHLOROBENZENE	SGH04	Y	0.5		0.33						
HEXACHLOROBENZENE	SGH08		0.75	1.5	0.33						
HEXACHLOROBENZENE	SGI10	Y	1.8		0.33						
HEXACHLOROBENZENE	SGJ06		0.8	1.6	0.33						
HEXACHLOROBENZENE	SGJ07		0.38	0.76	0.33						
HEXACHLOROBENZENE	SGK04		0.335	0.67	0.33						
HEXACHLOROBENZENE	SGOD06	Y	19		0.33						
HEXACHLOROBENZENE	SGOD17	Y	67		0.33						
HEXACHLOROBENZENE	SGOD20	Y	810		0.33						
LEAD	SCC102	Y	26.2			27	21.71481	9.36925	1.803113	1.706	24.79093
LEAD	SCC104	Y	21								
LEAD	SCC202	Y	26.4								
LEAD	SCC204	Y	24.6								
LEAD	SCC302	Y	16.1								
LEAD	SCC304	Y	18.7								
LEAD	SGBD05	Y	19.3								
LEAD	SGBD06	Y	11.2								
LEAD	SGC05	Y	5.9								
LEAD	SGC06	Y	26.7								
LEAD	SGC10	Y	24.6								
LEAD	SGD06	Y	22.4								
LEAD	SGD10	Y	24.3								
LEAD	SGDD01	Y	13.1								
LEAD	SGF07	Y	30.7								
LEAD	SGG03	Y	16.5								
LEAD	SGG08	Y	23.8								
LEAD	SGG09	Y	24.9								
LEAD	SGH04	Y	28.5								
LEAD	SGH08	Y	37.7								
LEAD	SGI10	Y	37.2								
LEAD	SGJ06	Y	44.2								
LEAD	SGJ07	Y	15.2								
LEAD	SGK04	Y	19.5								
LEAD	SGOD06	Y	10.7								
LEAD	SGOD17	Y	5.3								
LEAD	SGOD20	Y	11.6								
MERCURY	SCC101	Y	157			146	37.88024	66.06605	5.467666	1.654	46.92376
MERCURY	SCC102	Y	14.7								
MERCURY	SCC103	Y	0.52								
MERCURY	SCC104	Y	1.7								
MERCURY	SCC105		0.125	0.25							
MERCURY	SCC201	Y	135								
MERCURY	SCC202	Y	5								
MERCURY	SCC203	Y	42.6								
MERCURY	SCC204	Y	5.1								
MERCURY	SCC205	Y	33.2								
MERCURY	SCC301	Y	1.8								
MERCURY	SCC302	Y	26.8								
MERCURY	SCC303	Y	44.6								
MERCURY	SCC304	Y	12.2								
MERCURY	SCC305		0.075	0.15							
MERCURY	SGA07	Y	0.34								
MERCURY	SGB04	Y	21.6								
MERCURY	SGB05	Y	246								
MERCURY	SGB06	Y	57.8								

MERCURY	SGB07	Y	84	
MERCURY	SGB08	Y	10.2	
MERCURY	SGB09	Y	13.7	
MERCURY	SGB10		0.095	0.19
MERCURY	SGBD01	Y	4.8	
MERCURY	SGBD02	Y	3.9	
MERCURY	SGBD03	Y	5.8	
MERCURY	SGBD04	Y	4.5	
MERCURY	SGBD05	Y	3.7	
MERCURY	SGBD06	Y	4.3	
MERCURY	SGC04	Y	17	
MERCURY	SGC05	Y	7.1	
MERCURY	SGC06	Y	26.9	
MERCURY	SGC07	Y	21.3	
MERCURY	SGC08	Y	18.8	
MERCURY	SGC09	Y	9.8	
MERCURY	SGC10	Y	18.8	
MERCURY	SGD03	Y	128	
MERCURY	SGD04	Y	18.1	
MERCURY	SGD05	Y	26.2	
MERCURY	SGD06	Y	22.4	
MERCURY	SGD07	Y	12.9	
MERCURY	SGD08	Y	18.4	
MERCURY	SGD09	Y	10.7	
MERCURY	SGD10	Y	30.7	
MERCURY	SGD11	Y	15.6	
MERCURY	SGDD01	Y	3	
MERCURY	SGDD02	Y	4.2	
MERCURY	SGDD03	Y	2.2	
MERCURY	SGDD04	Y	0.28	
MERCURY	SGE02	Y	17.4	
MERCURY	SGE03	Y	9.3	
MERCURY	SGE04	Y	3.2	
MERCURY	SGE05	Y	97.5	
MERCURY	SGE06	Y	17.1	
MERCURY	SGE07	Y	22.6	
MERCURY	SGE08	Y	17.4	
MERCURY	SGE09	Y	7.8	
MERCURY	SGE10	Y	8	
MERCURY	SGF01	Y	3.1	
MERCURY	SGF02	Y	27.4	
MERCURY	SGF03	Y	3.7	
MERCURY	SGF04	Y	12.5	
MERCURY	SGF05	Y	66.3	
MERCURY	SGF06	Y	79	
MERCURY	SGF07	Y	34	
MERCURY	SGF08	Y	4.4	
MERCURY	SGF09	Y	8.7	
MERCURY	SGF10	Y	25.4	
MERCURY	SGG01	Y	5.3	
MERCURY	SGG02	Y	26.5	
MERCURY	SGG03	Y	20.1	
MERCURY	SGG04	Y	90	
MERCURY	SGG05	Y	24.6	
MERCURY	SGG06	Y	63.7	
MERCURY	SGG07	Y	29.5	
MERCURY	SGG08	Y	30.2	
MERCURY	SGG09	Y	31.2	
MERCURY	SGH02	Y	27.4	
MERCURY	SGH03	Y	80.8	
MERCURY	SGH04	Y	63.1	
MERCURY	SGH05	Y	6.8	
MERCURY	SGH06	Y	200	
MERCURY	SGH07	Y	26	
MERCURY	SGH08	Y	39	
MERCURY	SGH09	Y	25.2	

6930 8 3

MERCURY	SGH10	Y	0.39	
MERCURY	SGI03	Y	77.2	
MERCURY	SGI04	Y	116	
MERCURY	SGI05	Y	13.1	
MERCURY	SGI06	Y	137	
MERCURY	SGI07	Y	227	
MERCURY	SGI08	Y	29	
MERCURY	SGI09	Y	14.8	
MERCURY	SGI10	Y	290	
MERCURY	SGJ03	Y	20.2	
MERCURY	SGJ04	Y	14.8	
MERCURY	SGJ05	Y	9.8	
MERCURY	SGJ06	Y	135	
MERCURY	SGJ07	Y	37.4	
MERCURY	SGJ09	Y	30.9	
MERCURY	SGK04	Y	5.7	
MERCURY	SGK05	Y	1.3	
MERCURY	SGOD01	Y	0.3	
MERCURY	SGOD02	Y	0.13	
MERCURY	SGOD03	Y	1	
MERCURY	SGOD04	Y	0.19	
MERCURY	SGOD05	Y	0.88	
MERCURY	SGOD06	Y	1.8	
MERCURY	SGOD07		0.08	0.16
MERCURY	SGOD08	Y	1.1	
MERCURY	SGOD09	Y	0.92	
MERCURY	SGOD10		0.08	0.16
MERCURY	SGOD11	Y	10.4	
MERCURY	SGOD12	Y	9.7	
MERCURY	SGOD13	Y	0.31	
MERCURY	SGOD14	Y	0.48	
MERCURY	SGOD15	Y	4.9	
MERCURY	SGOD16	Y	0.82	
MERCURY	SGOD17	Y	0.87	
MERCURY	SGOD18	Y	0.39	
MERCURY	SGOD19	Y	0.58	
MERCURY	SGOD20	Y	0.41	
MERCURY	SGOD21	Y	0.48	
MERCURY	SGOD22	Y	0.49	
MERCURY	SGOD23	Y	0.12	
MERCURY	SGOD24	Y	0.34	
MERCURY	SGOD25	Y	115	
MERCURY	SCC206	Y	0.32	
MERCURY	SCC207		0.085	0.17
MERCURY	SCC208		0.075	0.15
MERCURY	SCE201	Y	5.1	
MERCURY	SCE202	Y	2.1	
MERCURY	SCE203	Y	3.4	
MERCURY	SCE204	Y	70.4	
MERCURY	SCE205		0.125	0.25
MERCURY	SCE206		0.105	0.21
MERCURY	SCI701	Y	214	
MERCURY	SCI702	Y	329	
MERCURY	SCI703	Y	214	
MERCURY	SCI704		0.125	0.25
MERCURY	SCI705		0.085	0.17
MERCURY	SCOD152	Y	167	
MERCURY	SCOD153	Y	337	
MERCURY	SCOD251	Y	213	
MERCURY	SCOD252	Y	52	
MERCURY	SCOD253	Y	3.5	

SEM = STANDARD ERROR MEASUREMENT
B = BETA

OLIN MCINTOSH ASSESSMENT DATA SURFACE WATER (ALL UNITS MG/L)
FILE: JFS-C:\R I.WQ1 MAY 21, 1992

PARAMETER	SAMPLE ID	DETECT?	CONC	DET LIM	CRQL/ CRDL	TOTAL RECORDS	MEAN	ST.DEV.	S.E.M.	B	95% UPPER CONF. LIMIT OF MEAN
ALPHA-BHC	WGBD03		2.5E-05	5.0E-05	5.0E-05	12	5.42E-05	6.87E-05	1.98E-05	1.796	8.98E-05
ALPHA-BHC	WGC901		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGC902		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGDD02	Y	1.8E-04		5.0E-05						
ALPHA-BHC	WGF201		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGG601		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGG602		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGH501		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGH502		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGH901		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGH902		2.5E-05	5.0E-05	5.0E-05						
ALPHA-BHC	WGOD25	Y	2.2E-04		5.0E-05						
ARSENIC	WGBD03		0.0015	0.003	0.01	12	0.002825	0.003309	0.000955	1.796	0.004541
ARSENIC	WGC901		0.0015	0.003	0.01						
ARSENIC	WGC902		0.0015	0.003	0.01						
ARSENIC	WGDD02	Y	0.0067		0.01						
ARSENIC	WGF201		0.0015	0.003	0.01						
ARSENIC	WGG601		0.0015	0.003	0.01						
ARSENIC	WGG602		0.0015	0.003	0.01						
ARSENIC	WGH501		0.0015	0.003	0.01						
ARSENIC	WGH502		0.0015	0.003	0.01						
ARSENIC	WGH901		0.0015	0.003	0.01						
ARSENIC	WGH902		0.0015	0.003	0.01						
ARSENIC	WGOD25	Y	0.0122		0.01						
CADMIUM	WGBD03		0.0010	0.002	0.005	12	0.001192	0.000448	0.000129	1.796	0.001424
CADMIUM	WGC901		0.0010	0.002	0.005						
CADMIUM	WGC902		0.0010	0.002	0.005						
CADMIUM	WGDD02		0.0010	0.002	0.005						
CADMIUM	WGF201		0.0010	0.002	0.005						
CADMIUM	WGG601		0.0010	0.002	0.005						
CADMIUM	WGG602		0.0010	0.002	0.005						
CADMIUM	WGH501		0.0010	0.002	0.005						
CADMIUM	WGH502	Y	0.0021		0.005						
CADMIUM	WGH901		0.0010	0.002	0.005						
CADMIUM	WGH902		0.0010	0.002	0.005						
CADMIUM	WGOD25	Y	0.0022		0.005						
CHROMIUM	WGBD03	Y	0.0085		0.01	12	0.004758	0.003063	0.000884	1.796	0.006346
CHROMIUM	WGC901		0.0020	0.004	0.01						
CHROMIUM	WGC902		0.0020	0.004	0.01						
CHROMIUM	WGDD02	Y	0.0078		0.01						
CHROMIUM	WGF201	Y	0.0043		0.01						
CHROMIUM	WGG601		0.0020	0.004	0.01						
CHROMIUM	WGG602	Y	0.0056		0.01						
CHROMIUM	WGH501	Y	0.0043		0.01						
CHROMIUM	WGH502	Y	0.0055		0.01						
CHROMIUM	WGH901		0.0020	0.004	0.01						
CHROMIUM	WGH902		0.0020	0.004	0.01						
CHROMIUM	WGOD25	Y	0.0111		0.01						
CYANIDE	WGBD03	Y	0.0146		0.01	12	0.014958	0.011538	0.003331	1.796	0.02094
CYANIDE	WGC901		0.0050	0.01	0.01						
CYANIDE	WGC902	Y	0.0280		0.01						
CYANIDE	WGDD02		0.0050	0.01	0.01						
CYANIDE	WGF201	Y	0.0324		0.01						
CYANIDE	WGG601	Y	0.0369		0.01						
CYANIDE	WGG602		0.0050	0.01	0.01						

38 0871

CYANIDE	WGH501	Y	0.0135								
CYANIDE	WGH502	Y	0.0168								
CYANIDE	WGH901	Y	0.0123		0.01						
CYANIDE	WGH902		0.0050	0.01	0.01						
CYANIDE	WGOD25		0.0050	0.01	0.01						
LEAD	WGBD03		0.0015	0.003	0.003	12	0.002042	0.000982	0.000284	1.796	0.002551
LEAD	WGC901		0.0015	0.003	0.003						
LEAD	WGC902		0.0015	0.003	0.003						
LEAD	WGDD02	Y	0.0038		0.003						
LEAD	WGF201		0.0015	0.003	0.003						
LEAD	WGG601	Y	0.0035		0.003						
LEAD	WGG602		0.0015	0.003	0.003						
LEAD	WGH501		0.0015	0.003	0.003						
LEAD	WGH502		0.0015	0.003	0.003						
LEAD	WGH901		0.0015	0.003	0.003						
LEAD	WGH902		0.0015	0.003	0.003						
LEAD	WGOD25	Y	0.0037		0.003						
MERCURY	WGBD03	Y	0.0011		0.0002	12	0.00137	0.000794	0.000229	1.796	0.001781
MERCURY	WGC901	Y	0.00026		0.0002						
MERCURY	WGC902	Y	0.00045		0.0002						
MERCURY	WGDD02	Y	0.0028		0.0002						
MERCURY	WGF201	Y	0.0015		0.0002						
MERCURY	WGG601	Y	0.0011		0.0002						
MERCURY	WGG602	Y	0.00083		0.0002						
MERCURY	WGH501	Y	0.0015		0.0002						
MERCURY	WGH502	Y	0.0018		0.0002						
MERCURY	WGH901	Y	0.0011		0.0002						
MERCURY	WGH902	Y	0.0012		0.0002						
MERCURY	WGOD25	Y	0.0028		0.0002						
NICKEL	WGBD03		0.0050	0.01	0.04	12	0.013267	0.011994	0.003462	1.796	0.019485
NICKEL	WGC901	Y	0.0122		0.04						
NICKEL	WGC902	Y	0.0210		0.04						
NICKEL	WGDD02	Y	0.0230		0.04						
NICKEL	WGF201		0.0050	0.01	0.04						
NICKEL	WGG601	Y	0.0108		0.04						
NICKEL	WGG602		0.0050	0.01	0.04						
NICKEL	WGH501	Y	0.0102		0.04						
NICKEL	WGH502		0.0050	0.01	0.04						
NICKEL	WGH901		0.0050	0.01	0.04						
NICKEL	WGH902	Y	0.0111		0.04						
NICKEL	WGOD25	Y	0.0459		0.04						
ZINC	WGBD03	Y	0.0988		0.02	12	0.131329	0.110106	0.031785	1.796	0.188415
ZINC	WGC901	Y	0.0881		0.02						
ZINC	WGC902	Y	0.0865		0.02						
ZINC	WGDD02	Y	0.2150		0.02						
ZINC	WGF201	Y	0.1110		0.02						
ZINC	WGG601D	Y	0.1210		0.02						
ZINC	WGG602	Y	0.1660		0.02						
ZINC	WGH501	Y	0.0599		0.02						
ZINC	WGH502	Y	0.0836		0.02						
ZINC	WGH901	Y	0.0798		0.02						
ZINC	WGH902		0.0223	0.0445	0.02						
ZINC	WGOD25	Y	0.4440		0.02						

SEM = STANDARD ERROR MEASUREMENT
B = BETA

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PARAMETER	SAMPLE ID	DETECT?	CONC	DET LIM	(N) TOTAL RECORDS	($\bar{X}$) MEAN	ST.DEV.	S.E.M.	B	95% UPPER CONF. LIMIT OF MEAN
1,1,2,2-TETRACHLOROETHANE	DW-01		0.001	0.002	34	0.000979	0.00012	2.06E-05	1.692	0.001014
1,1,2,2-TETRACHLOROETHANE	DW-03		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-04		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-05A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-06		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-07		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-08		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-11		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-12		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-16		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-17		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-18		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-19A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-20		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW21A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-22		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-23-1		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-24		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-25	Y	0.0003							
1,1,2,2-TETRACHLOROETHANE	DW-26		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-27		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-28		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-29		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-30		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-31		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-32		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-34		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-35A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-37A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-38A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-39A		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-40		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW-41		0.001	0.002						
1,1,2,2-TETRACHLOROETHANE	DW42A		0.001	0.002						
CHLOROBENZENE	DW-01		0.001	0.002	34	0.000976	0.000137	2.35E-05	1.692	0.001016
CHLOROBENZENE	DW-03		0.001	0.002						
CHLOROBENZENE	DW-04		0.001	0.002						
CHLOROBENZENE	DW-05A		0.001	0.002						
CHLOROBENZENE	DW-06		0.001	0.002						
CHLOROBENZENE	DW-07		0.001	0.002						
CHLOROBENZENE	DW-08		0.001	0.002						
CHLOROBENZENE	DW-11		0.001	0.002						
CHLOROBENZENE	DW-12		0.001	0.002						
CHLOROBENZENE	DW-16		0.001	0.002						
CHLOROBENZENE	DW-17		0.001	0.002						
CHLOROBENZENE	DW-18		0.001	0.002						
CHLOROBENZENE	DW-19A		0.001	0.002						
CHLOROBENZENE	DW-20	Y	0.0002							
CHLOROBENZENE	DW21A		0.001	0.002						
CHLOROBENZENE	DW-22		0.001	0.002						
CHLOROBENZENE	DW-23-1		0.001	0.002						
CHLOROBENZENE	DW-24		0.001	0.002						
CHLOROBENZENE	DW-25		0.001	0.002						
CHLOROBENZENE	DW-26		0.001	0.002						
CHLOROBENZENE	DW-27		0.001	0.002						
CHLOROBENZENE	DW-28		0.001	0.002						
CHLOROBENZENE	DW-29		0.001	0.002						
CHLOROBENZENE	DW-30		0.001	0.002						

3 8 0873

CHLOROBENZEN	DW-31		0.001	0.002						
CHLOROBENZEN	DW-32		0.001	0.002						
CHLOROBENZENE	DW-34		0.001	0.002						
CHLOROBENZENE	DW-35A		0.001	0.002						
CHLOROBENZENE	DW-37A		0.001	0.002						
CHLOROBENZENE	DW-38A		0.001	0.002						
CHLOROBENZENE	DW-39A		0.001	0.002						
CHLOROBENZENE	DW-40		0.001	0.002						
CHLOROBENZENE	DW-41		0.001	0.002						
CHLOROBENZENE	DW42A		0.001	0.002						
CHOLOROFORM	DW-01		0.001	0.002	34	0.001521	0.002378	0.000408	1.692	0.002211
CHOLOROFORM	DW-03		0.001	0.002						
CHOLOROFORM	DW-04		0.001	0.002						
CHOLOROFORM	DW-05A		0.001	0.002						
CHOLOROFORM	DW-06		0.001	0.002						
CHOLOROFORM	DW-07		0.001	0.002						
CHOLOROFORM	DW-08	Y	0.0002							
CHOLOROFORM	DW-11		0.001	0.002						
CHOLOROFORM	DW-12	Y	0.0003							
CHOLOROFORM	DW-16		0.001	0.002						
CHOLOROFORM	DW-17		0.001	0.002						
CHOLOROFORM	DW-18		0.001	0.002						
CHOLOROFORM	DW-19A		0.001	0.002						
CHOLOROFORM	DW-20		0.001	0.002						
CHOLOROFORM	DW21A		0.001	0.002						
CHOLOROFORM	DW-22		0.001	0.002						
CHOLOROFORM	DW-23-1		0.001	0.002						
CHOLOROFORM	DW-24		0.001	0.002						
CHOLOROFORM	DW-25		0.001	0.002						
CHOLOROFORM	DW-26	Y	0.013							
CHOLOROFORM	DW-27	Y	0.001							
CHOLOROFORM	DW-28		0.001	0.002						
CHOLOROFORM	DW-29		0.001	0.002						
CHOLOROFORM	DW-30		0.001	0.002						
CHOLOROFORM	DW-31		0.001	0.002						
CHOLOROFORM	DW-32		0.001	0.002						
CHOLOROFORM	DW-34	Y	0.001							
CHOLOROFORM	DW-35A	Y	0.002							
CHOLOROFORM	DW-37A		0.001	0.002						
CHOLOROFORM	DW-38A		0.001	0.002						
CHOLOROFORM	DW-39A	Y	0.008							
CHOLOROFORM	DW-40		0.001	0.002						
CHOLOROFORM	DW-41		0.001	0.002						
CHOLOROFORM	DW42A	Y	0.0002							
MERCURY	DW-01		0.0001	0.0002	34	0.000108	4.63E-05	7.94E-06	1.692	0.000121
MERCURY	DW-03		0.0001	0.0002						
MERCURY	DW-04		0.0001	0.0002						
MERCURY	DW-05A		0.0001	0.0002						
MERCURY	DW-06		0.0001	0.0002						
MERCURY	DW-07		0.0001	0.0002						
MERCURY	DW-08		0.0001	0.0002						
MERCURY	DW-11		0.0001	0.0002						
MERCURY	DW-12		0.0001	0.0002						
MERCURY	DW-16		0.0001	0.0002						
MERCURY	DW-17		0.0001	0.0002						
MERCURY	DW-18		0.0001	0.0002						
MERCURY	DW-19A		0.0001	0.0002						
MERCURY	DW-20		0.0001	0.0002						
MERCURY	DW-21A		0.0001	0.0002						
MERCURY	DW-22		0.0001	0.0002						
MERCURY	DW-23-1		0.0001	0.0002						
MERCURY	DW-24		0.0001	0.0002						
MERCURY	DW-25		0.0001	0.0002						
MERCURY	DW-26		0.0001	0.0002						

MERCURY	DW-27		0.0001	0.0002						
MERCURY	DW-28		0.0001	0.0002						
MERCURY	DW-29		0.0001	0.0002						
MERCURY	DW-30		0.0001	0.0002						
MERCURY	DW-31		0.0001	0.0002						
MERCURY	DW-32		0.0001	0.0002						
MERCURY	DW-34		0.0001	0.0002						
MERCURY	DW-35A		0.0001	0.0002						
MERCURY	DW-37A		0.0001	0.0002						
MERCURY	DW-38A		0.0001	0.0002						
MERCURY	DW-39A		0.0001	0.0002						
MERCURY	DW-40	Y	0.00037							
MERCURY	DW-41		0.0001	0.0002						
MERCURY	DW-42A		0.0001	0.0002						
TETRACHLOROETHENE	DW-01		0.001	0.002	34	0.000979	0.00012	2.06E-05	1.692	0.001014
TETRACHLOROETHENE	DW-03		0.001	0.002						
TETRACHLOROETHENE	DW-04		0.001	0.002						
TETRACHLOROETHENE	DW-05A		0.001	0.002						
TETRACHLOROETHENE	DW-06		0.001	0.002						
TETRACHLOROETHENE	DW-07	Y	0.0003							
TETRACHLOROETHENE	DW-08		0.001	0.002						
TETRACHLOROETHENE	DW-11		0.001	0.002						
TETRACHLOROETHENE	DW-12		0.001	0.002						
TETRACHLOROETHENE	DW-16		0.001	0.002						
TETRACHLOROETHENE	DW-17		0.001	0.002						
TETRACHLOROETHENE	DW-18		0.001	0.002						
TETRACHLOROETHENE	DW-19A		0.001	0.002						
TETRACHLOROETHENE	DW-20		0.001	0.002						
TETRACHLOROETHENE	DW21A		0.001	0.002						
TETRACHLOROETHENE	DW-22		0.001	0.002						
TETRACHLOROETHENE	DW-23-1		0.001	0.002						
TETRACHLOROETHENE	DW-24		0.001	0.002						
TETRACHLOROETHENE	DW-25		0.001	0.002						
TETRACHLOROETHENE	DW-26		0.001	0.002						
TETRACHLOROETHENE	DW-27		0.001	0.002						
TETRACHLOROETHENE	DW-28		0.001	0.002						
TETRACHLOROETHENE	DW-29		0.001	0.002						
TETRACHLOROETHENE	DW-30		0.001	0.002						
TETRACHLOROETHENE	DW-31		0.001	0.002						
TETRACHLOROETHENE	DW-32		0.001	0.002						
TETRACHLOROETHENE	DW-34		0.001	0.002						
TETRACHLOROETHENE	DW-35A		0.001	0.002						
TETRACHLOROETHENE	DW-37A		0.001	0.002						
TETRACHLOROETHENE	DW-38A		0.001	0.002						
TETRACHLOROETHENE	DW-39A		0.001	0.002						
TETRACHLOROETHENE	DW-40		0.001	0.002						
TETRACHLOROETHENE	DW-41		0.001	0.002						
TETRACHLOROETHENE	DW42A		0.001	0.002						

SEM = STANDARD ERROR MEASUREMENT
B = BETA

APPENDIX C

INTAKE FACTORS SUMMARY FOR OLIN-MCINTOSH

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Olin McIntosh Intake Detail

Description: Offsite Child Res. Groundwater Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times FI \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (l/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
FI	Fraction Contaminated
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$6.85E\text{-}03 = \frac{(1 \times 3.50E{+}02 \times 9.00E{+}00 \times 1 \times 1)}{(1.80E{+}01 \times 2.56E{+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$5.71E\text{-}03 = \frac{(1 \times 3.50E{+}02 \times 2.00E{+}01 \times 1 \times 1)}{(4.80E{+}01 \times 2.56E{+}04)}$$

Average Exposure, Non-Carcinogenic:

$$5.33E\text{-}02 = \frac{(1 \times 3.50E{+}02 \times 9.00E{+}00 \times 1 \times 1)}{(1.80E{+}01 \times 3.29E{+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$2.00E\text{-}02 = \frac{(1 \times 3.50E{+}02 \times 2.00E{+}01 \times 1 \times 1)}{(4.80E{+}01 \times 7.30E{+}03)}$$

Olin McIntosh Intake Detail

Description: Offsite Adult Res. Groundwater Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times FI \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (l/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
FI	Fraction Contaminated
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$2.47E\text{-}03 = \frac{(1.40E{+}00 \times 3.50E{+}02 \times 9.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 2.56E{+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$1.17E\text{-}02 = \frac{(2.00E{+}00 \times 3.50E{+}02 \times 3.00E{+}01 \times 1 \times 1)}{(7.00E{+}01 \times 2.56E{+}04)}$$

Average Exposure, Non-Carcinogenic:

$$1.92E\text{-}02 = \frac{(1.40E{+}00 \times 3.50E{+}02 \times 9.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 3.29E{+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$2.74E\text{-}02 = \frac{(2.00E{+}00 \times 3.50E{+}02 \times 3.00E{+}01 \times 1 \times 1)}{(7.00E{+}01 \times 1.10E{+}04)}$$

Olin McIntosh Intake Detail

Description: Offsite Child Res. Sur. Water Ingestion

$$\text{Intake Factor} = \frac{(\text{IR} \times \text{EF} \times \text{ED} \times \text{FI} \times \text{SS})}{(\text{BW} \times \text{AT})}$$

Parameter	Description
IR	Ingestion Rate (l/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
FI	Fraction Contaminated
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$5.87\text{E-}06 = \frac{(5.00\text{E-}02 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 1 \times 1)}{(1.80\text{E+}01 \times 2.56\text{E+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$1.96\text{E-}05 = \frac{(1.00\text{E-}01 \times 1.20\text{E+}01 \times 2.00\text{E+}01 \times 1 \times 1)}{(4.80\text{E+}01 \times 2.56\text{E+}04)}$$

Average Exposure, Non-Carcinogenic:

$$4.57\text{E-}05 = \frac{(5.00\text{E-}02 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 1 \times 1)}{(1.80\text{E+}01 \times 3.29\text{E+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$6.85\text{E-}05 = \frac{(1.00\text{E-}01 \times 1.20\text{E+}01 \times 2.00\text{E+}01 \times 1 \times 1)}{(4.80\text{E+}01 \times 7.30\text{E+}03)}$$

Olin McIntosh Intake Detail

Description: Offsite Adult Res. Sur. Water Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times FI \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (l/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
FI	Fraction Contaminated
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$1.51E\text{-}06 = \frac{(5.00E\text{-}02 \times 6.00E{+}00 \times 9.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 2.56E{+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$2.01E\text{-}05 = \frac{(1.00E\text{-}01 \times 1.20E{+}01 \times 3.00E{+}01 \times 1 \times 1)}{(7.00E{+}01 \times 2.56E{+}04)}$$

Average Exposure, Non-Carcinogenic:

$$1.17E\text{-}05 = \frac{(5.00E\text{-}02 \times 6.00E{+}00 \times 9.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 3.29E{+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$4.70E\text{-}05 = \frac{(1.00E\text{-}01 \times 1.20E{+}01 \times 3.00E{+}01 \times 1 \times 1)}{(7.00E{+}01 \times 1.10E{+}04)}$$

Olin McIntosh Intake Detail

Description: Future Rem. Worker Sur. Water Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times FI \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (l/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
FI	Fraction Contaminated
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$1.40E\text{-}05 = \frac{(5.00E\text{-}02 \times 2.50E{+}02 \times 2.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 2.56E{+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$2.80E\text{-}05 = \frac{(5.00E\text{-}02 \times 2.50E{+}02 \times 4.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 2.56E{+}04)}$$

Average Exposure, Non-Carcinogenic:

$$4.89E\text{-}04 = \frac{(5.00E\text{-}02 \times 2.50E{+}02 \times 2.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 7.30E{+}02)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$4.89E\text{-}04 = \frac{(5.00E\text{-}02 \times 2.50E{+}02 \times 4.00E{+}00 \times 1 \times 1)}{(7.00E{+}01 \times 1.46E{+}03)}$$

Olin McIntosh Intake Detail

Description: Offsite Child Res. Sediment Ingestion

$$\text{Intake Factor} = \frac{(\text{IR} \times \text{EF} \times \text{ED} \times \text{ME} \times \text{FI} \times \text{CF} \times \text{SS})}{(\text{BW} \times \text{AT})}$$

Parameter	Description
IR	Ingestion Rate (mg/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$5.87\text{E-}10 = \frac{(1.00\text{E+}02 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 5.00\text{E-}01 \times 1.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(1.80\text{E+}01 \times 2.56\text{E+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.91\text{E-}09 = \frac{(2.00\text{E+}02 \times 1.20\text{E+}01 \times 2.00\text{E+}01 \times 5.00\text{E-}01 \times 2.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(4.80\text{E+}01 \times 2.56\text{E+}04)}$$

Average Exposure, Non-Carcinogenic:

$$4.57\text{E-}09 = \frac{(1.00\text{E+}02 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 5.00\text{E-}01 \times 1.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(1.80\text{E+}01 \times 3.29\text{E+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$1.37\text{E-}08 = \frac{(2.00\text{E+}02 \times 1.20\text{E+}01 \times 2.00\text{E+}01 \times 5.00\text{E-}01 \times 2.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(4.80\text{E+}01 \times 7.30\text{E+}03)}$$

Olin McIntosh Intake Detail

Description: Offsite Adult Res. Sediment Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times ME \times FI \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (mg/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$7.55E\text{-}11 = \frac{(5.00E+01 \times 6.00E+00 \times 9.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$:.01E\text{-}09 = \frac{(1.00E+02 \times 1.20E+01 \times 3.00E+01 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Average Exposure, Non-Carcinogenic:

$$5.87E\text{-}10 = \frac{(5.00E+01 \times 6.00E+00 \times 9.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 3.29E+03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$4.70E\text{-}09 = \frac{(1.00E+02 \times 1.20E+01 \times 3.00E+01 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 1.10E+04)}$$

Olin McIntosh Intake Detail

Jescription: Future Rem. Worker Sediment Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times ME \times FI \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (mg/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$6.99E\text{-}11 = \frac{(5.00E+00 \times 2.50E+02 \times 2.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.59E\text{-}10 = \frac{(1.00E+01 \times 2.50E+02 \times 4.00E+00 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Average Exposure, Non-Carcinogenic:

$$2.45E\text{-}09 = \frac{(5.00E+00 \times 2.50E+02 \times 2.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 7.30E+02)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$9.78E\text{-}09 = \frac{(1.00E+01 \times 2.50E+02 \times 4.00E+00 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 1.46E+03)}$$

Olin McIntosh Intake Detail

Description: Offsite Child Res. Fish/Game Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times ME \times FI \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (mg/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$6.25E\text{-}07 = \frac{(1.75E+03 \times 3.65E+02 \times 9.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(1.80E+01 \times 2.56E+04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.45E\text{-}05 = \frac{(2.44E+04 \times 3.65E+02 \times 2.00E+01 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(4.80E+01 \times 2.56E+04)}$$

Average Exposure, Non-Carcinogenic:

$$4.86E\text{-}06 = \frac{(1.75E+03 \times 3.65E+02 \times 9.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(1.80E+01 \times 3.29E+03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$5.09E\text{-}05 = \frac{(2.44E+04 \times 3.65E+02 \times 2.00E+01 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(4.80E+01 \times 7.30E+03)}$$

Olin McIntosh Intake Detail

Description: Offsite Adult Res. Fish/Game Ingestion

$$\text{Intake Factor} = \frac{(IR \times EF \times ED \times ME \times FI \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
IR	Ingestion Rate (mg/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$6.24E\text{-}07 = \frac{(6.80E+03 \times 3.65E+02 \times 9.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$2.18E\text{-}05 = \frac{(3.56E+04 \times 3.65E+02 \times 3.00E+01 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Average Exposure, Non-Carcinogenic:

$$4.86E\text{-}06 = \frac{(6.80E+03 \times 3.65E+02 \times 9.00E+00 \times 5.00E\text{-}01 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 3.29E+03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$5.09E\text{-}05 = \frac{(3.56E+04 \times 3.65E+02 \times 3.00E+01 \times 5.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(7.00E+01 \times 1.10E+04)}$$

Olin McIntosh Intake Detail

Description: Offsite Child Res. G. Water Dermal

$$\text{Intake Factor} = \frac{(\,SA \times ET \times EF \times ED \times PC \times CF \times SS\,)}{(\,BW \times AT\,)}$$

Parameter	Description
SA	Surface Area (cm2)
ET	Exposure Time (hrs/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
PC	Permeability Constant (cm/hr)
CF	Conversion Factor (l/cm3)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$3.32E\text{-}05 = \frac{(\,1.21E{+}04 \times 5.00E\text{-}01 \times 3.50E{+}02 \times 9.00E{+}00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,1.80E{+}01 \times 2.56E{+}04\,)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.53E\text{-}05 = \frac{(\,1.21E{+}04 \times 1 \times 3.50E{+}02 \times 2.00E{+}01 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,4.80E{+}01 \times 2.56E{+}04\,)}$$

Average Exposure, Non-Carcinogenic:

$$2.58E\text{-}04 = \frac{(\,1.21E{+}04 \times 5.00E\text{-}01 \times 3.50E{+}02 \times 9.00E{+}00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,1.80E{+}01 \times 3.29E{+}03\,)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$1.94E\text{-}04 = \frac{(\,1.21E{+}04 \times 1 \times 3.50E{+}02 \times 2.00E{+}01 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,4.80E{+}01 \times 7.30E{+}03\,)}$$

Olin McIntosh Intake Detail

Description: Offsite Adult Res. G.Water Dermal

$$\text{Intake Factor} = \frac{(\,SA \times ET \times EF \times ED \times PC \times CF \times SS\,)}{(\,BW \times AT\,)}$$

Parameter	Description
SA	Surface Area (cm2)
ET	Exposure Time (hrs/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
PC	Permeability Constant (cm/hr)
CF	Conversion Factor (l/cm3)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$1.37E\text{-}05 = \frac{(\,1.94E{+}04 \times 5.00E\text{-}01 \times 3.50E{+}02 \times 9.00E{+}00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,7.00E{+}01 \times 2.56E{+}04\,)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.11E\text{-}05 = \frac{(\,1.94E{+}04 \times 1 \times 3.50E{+}02 \times 3.00E{+}01 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,7.00E{+}01 \times 2.56E{+}04\,)}$$

Average Exposure, Non-Carcinogenic:

$$1.06E\text{-}04 = \frac{(\,1.94E{+}04 \times 5.00E\text{-}01 \times 3.50E{+}02 \times 9.00E{+}00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,7.00E{+}01 \times 3.29E{+}03\,)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$2.13E\text{-}04 = \frac{(\,1.94E{+}04 \times 1 \times 3.50E{+}02 \times 3.00E{+}01 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\,)}{(\,7.00E{+}01 \times 1.10E{+}04\,)}$$

Olin McIntosh Intake Detail

Description: Offsite Child Res. Sediment Dermal

$$\text{Intake Factor} = \frac{(SA \times EF \times ED \times ME \times AF \times AB \times FI \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
SA	Surface Area (cm2/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
AF	Adherence Factor (mg/cm2)
AB	Absorption Factor
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$2.13E\text{-}10 = \frac{(1.21E{+}03 \times 6.00E{+}00 \times 9.00E{+}00 \times 5.00E\text{-}01 \times 6.00E\text{-}01 \times 5.00E\text{-}02 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(1.80E{+}01 \times 2.56E{+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$2.85E\text{-}09 = \frac{(2.42E{+}03 \times 1.20E{+}01 \times 2.00E{+}01 \times 5.00E\text{-}01 \times 6.00E\text{-}01 \times 1.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(4.80E{+}01 \times 2.56E{+}04)}$$

Average Exposure, Non-Carcinogenic:

$$1.66E\text{-}09 = \frac{(1.21E{+}03 \times 6.00E{+}00 \times 9.00E{+}00 \times 5.00E\text{-}01 \times 6.00E\text{-}01 \times 5.00E\text{-}02 \times 1.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(1.80E{+}01 \times 3.29E{+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$9.96E\text{-}09 = \frac{(2.42E{+}03 \times 1.20E{+}01 \times 2.00E{+}01 \times 5.00E\text{-}01 \times 6.00E\text{-}01 \times 1.00E\text{-}01 \times 2.00E\text{-}01 \times 1.00E\text{-}06 \times 1)}{(4.80E{+}01 \times 7.30E{+}03)}$$

Olin McIntosh Intake Detail

Description: Offsite Adult Res. Sediment Dermal

$$\text{Intake Factor} = \frac{(\text{SA} \times \text{EF} \times \text{ED} \times \text{ME} \times \text{AF} \times \text{AB} \times \text{FI} \times \text{CF} \times \text{SS})}{(\text{BW} \times \text{AT})}$$

Parameter	Description
SA	Surface Area (cm2/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
AF	Adherence Factor (mg/cm2)
AB	Absorption Factor
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$8.79\text{E-}11 = \frac{(1.94\text{E+}03 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 5.00\text{E-}01 \times 6.00\text{E-}01 \times 5.00\text{E-}02 \times 1.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(7.00\text{E+}01 \times 2.56\text{E+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$4.69\text{E-}09 = \frac{(3.88\text{E+}03 \times 1.20\text{E+}01 \times 3.00\text{E+}01 \times 5.00\text{E-}01 \times 6.00\text{E-}01 \times 1.00\text{E-}01 \times 2.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(7.00\text{E+}01 \times 2.56\text{E+}04)}$$

Average Exposure, Non-Carcinogenic:

$$6.83\text{E-}10 = \frac{(1.94\text{E+}03 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 5.00\text{E-}01 \times 6.00\text{E-}01 \times 5.00\text{E-}02 \times 1.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(7.00\text{E+}01 \times 3.29\text{E+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$1.09\text{E-}08 = \frac{(3.88\text{E+}03 \times 1.20\text{E+}01 \times 3.00\text{E+}01 \times 5.00\text{E-}01 \times 6.00\text{E-}01 \times 1.00\text{E-}01 \times 2.00\text{E-}01 \times 1.00\text{E-}06 \times 1)}{(7.00\text{E+}01 \times 1.10\text{E+}04)}$$

Olin McIntosh Intake Detail

Description: Future Remedial Work. Sediment Dermal

$$\text{Intake Factor} = \frac{(SA \times EF \times ED \times ME \times AF \times AB \times FI \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
SA	Surface Area (cm2/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
ME	Matrix Effect
AF	Adherence Factor (mg/cm2)
AB	Absorption Factor
FI	Fraction Contaminated
CF	Conversion Factor (kg/mg)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$3.25E-10 = \frac{(7.76E+02 \times 2.50E+02 \times 2.00E+00 \times 5.00E-01 \times 6.00E-01 \times 5.00E-02 \times 1.00E-01 \times 1.00E-06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$5.21E-09 = \frac{(1.55E+03 \times 2.50E+02 \times 4.00E+00 \times 5.00E-01 \times 6.00E-01 \times 1.00E-01 \times 2.00E-01 \times 1.00E-06 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Average Exposure, Non-Carcinogenic:

$$1.14E-08 = \frac{(7.76E+02 \times 2.50E+02 \times 2.00E+00 \times 5.00E-01 \times 6.00E-01 \times 5.00E-02 \times 1.00E-01 \times 1.00E-06 \times 1)}{(7.00E+01 \times 7.30E+02)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$9.11E-08 = \frac{(1.55E+03 \times 2.50E+02 \times 4.00E+00 \times 5.00E-01 \times 6.00E-01 \times 1.00E-01 \times 2.00E-01 \times 1.00E-06 \times 1)}{(7.00E+01 \times 1.46E+03)}$$

Olin McIntosh Intake Detail

Description: Offsite Child Res. Sur.Water Dermal

$$\text{Intake Factor} = \frac{(\text{SA} \times \text{ET} \times \text{EF} \times \text{ED} \times \text{PC} \times \text{CF} \times \text{SS})}{(\text{BW} \times \text{AT})}$$

Parameter	Description
SA	Surface Area (cm2)
ET	Exposure Time (hrs/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
PC	Permeability Constant (cm/hr)
CF	Conversion Factor (l/cm3)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$2.28\text{E-}07 = \frac{(1.21\text{E+}03 \times 2.00\text{E+}00 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 8.00\text{E-}04 \times 1.00\text{E-}03 \times 1)}{(1.80\text{E+}01 \times 2.56\text{E+}04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.52\text{E-}06 = \frac{(2.42\text{E+}03 \times 4.00\text{E+}00 \times 1.20\text{E+}01 \times 2.00\text{E+}01 \times 8.00\text{E-}04 \times 1.00\text{E-}03 \times 1)}{(4.80\text{E+}01 \times 2.56\text{E+}04)}$$

Average Exposure, Non-Carcinogenic:

$$1.77\text{E-}06 = \frac{(1.21\text{E+}03 \times 2.00\text{E+}00 \times 6.00\text{E+}00 \times 9.00\text{E+}00 \times 8.00\text{E-}04 \times 1.00\text{E-}03 \times 1)}{(1.80\text{E+}01 \times 3.29\text{E+}03)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$3.54\text{E-}06 = \frac{(2.42\text{E+}03 \times 4.00\text{E+}00 \times 1.20\text{E+}01 \times 2.00\text{E+}01 \times 8.00\text{E-}04 \times 1.00\text{E-}03 \times 1)}{(4.80\text{E+}01 \times 1.10\text{E+}04)}$$

Olin McIntosh Intake Detail

3 8 0893

Description: Offsite Adult Res. Sur.Water Dermal

$$\text{Intake Factor} = \frac{(\ SA \times ET \times EF \times ED \times PC \times CF \times SS\ )}{(\ BW \times AT\ )}$$

Parameter	Description
SA	Surface Area (cm2)
ET	Exposure Time (hrs/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
PC	Permeability Constant (cm/hr)
CF	Conversion Factor (l/cm3)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$9.37E\text{-}08 = \frac{(\ 1.94E+03 \times 2.00E+00 \times 6.00E+00 \times 9.00E+00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\ )}{(\ 7.00E+01 \times 2.56E+04\ )}$$

Reasonable Maximum Exposure, Carcinogenic:

$$.50E\text{-}06 = \frac{(\ 3.88E+03 \times 4.00E+00 \times 1.20E+01 \times 3.00E+01 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\ )}{(\ 7.00E+01 \times 2.56E+04\ )}$$

Average Exposure, Non-Carcinogenic:

$$7.29E\text{-}07 = \frac{(\ 1.94E+03 \times 2.00E+00 \times 6.00E+00 \times 9.00E+00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\ )}{(\ 7.00E+01 \times 3.29E+03\ )}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$8.75E\text{-}06 = \frac{(\ 3.88E+03 \times 4.00E+00 \times 1.20E+01 \times 3.00E+01 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1\ )}{(\ 7.00E+01 \times 7.30E+03\ )}$$

Olin McIntosh Intake Detail

Description: Future Rem. Worker Sur. Water Dermal

$$\text{Intake Factor} = \frac{(SA \times ET \times EF \times ED \times PC \times CF \times SS)}{(BW \times AT)}$$

Parameter	Description
SA	Surface Area (cm2)
ET	Exposure Time (hrs/day)
EF	Exposure Frequency (days/year)
ED	Exposure Duration (years)
PC	Permeability Constant (cm/hr)
CF	Conversion Factor (l/cm3)
SS	Site-Specific Factor
BW	Body Weight (kg)
AT	Averaging Time (days)

Average Exposure, Carcinogenic:

$$6.94E\text{-}07 = \frac{(7.76E+02 \times 4.00E+00 \times 2.50E+02 \times 2.00E+00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Reasonable Maximum Exposure, Carcinogenic:

$$5.55E\text{-}06 = \frac{(1.55E+03 \times 8.00E+00 \times 2.50E+02 \times 4.00E+00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1)}{(7.00E+01 \times 2.56E+04)}$$

Average Exposure, Non-Carcinogenic:

$$2.43E\text{-}05 = \frac{(7.76E+02 \times 4.00E+00 \times 2.50E+02 \times 2.00E+00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1)}{(7.00E+01 \times 7.30E+02)}$$

Reasonable Maximum Exposure, Non-Carcinogenic:

$$9.72E\text{-}05 = \frac{(1.55E+03 \times 8.00E+00 \times 2.50E+02 \times 4.00E+00 \times 8.00E\text{-}04 \times 1.00E\text{-}03 \times 1)}{(7.00E+01 \times 1.46E+03)}$$

APPENDIX D

PATHWAY-SPECIFIC ESTIMATED DAILY INTAKES OF CHEMICALS OF POTENTIAL CONCERN UNDER AVERAGE AND REASONABLE MAXIMUM EXPOSURE SCENARIOS

Offsite Child Resident
Offsite Child Res. Sur. Water Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	5.42E-05	2.28E-07	1.23E-11
arsenic	2.83E-03	2.28E-07	6.43E-10

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	1.77E-06	5.00E-09
cadmium	1.19E-03	1.77E-06	2.11E-09
cyanide	1.50E-02	1.77E-06	2.65E-08
mercury	1.37E-03	1.77E-06	2.43E-09
nickel	1.33E-02	1.77E-06	2.35E-08
chromium (VI)	4.76E-03	1.77E-06	8.43E-09
zinc	1.31E-01	1.77E-06	2.33E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	1.77E-06	5.00E-09
cadmium	1.19E-03	1.77E-06	2.11E-09
cyanide	1.50E-02	1.77E-06	2.65E-08
mercury	1.37E-03	1.77E-06	2.43E-09
nickel	1.33E-02	1.77E-06	2.35E-08
chromium (VI)	4.76E-03	1.77E-06	8.43E-09
zinc	1.31E-01	1.77E-06	2.33E-07

Offsite Child Resident
Offsite Child Res. Sur. Water Dermal
Reasonable Maximum Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	8.98E-05	1.52E-06	1.36E-10
arsenic	4.54E-03	1.52E-06	6.89E-09

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	3.54E-06	1.61E-08
cadmium	1.42E-03	3.54E-06	5.04E-09
cyanide	2.09E-02	3.54E-06	7.42E-08
mercury	1.78E-03	3.54E-06	6.31E-09
nickel	1.95E-02	3.54E-06	6.90E-08
chromium (VI)	6.35E-03	3.54E-06	2.25E-08
zinc	1.88E-01	3.54E-06	6.67E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	3.54E-06	1.61E-08
cadmium	1.42E-03	3.54E-06	5.04E-09
cyanide	2.09E-02	3.54E-06	7.42E-08
mercury	1.78E-03	3.54E-06	6.31E-09
nickel	1.95E-02	3.54E-06	6.90E-08
chromium (VI)	6.35E-03	3.54E-06	2.25E-08
zinc	1.88E-01	3.54E-06	6.67E-07

Offsite Child Resident
Offiste Child Res. G. Water Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	1.52E-03	3.32E-05	5.05E-08
1,1,2,2-tetrachloroethane	9.79E-04	3.32E-05	3.25E-08
tetrachloroethene	9.79E-04	3.32E-05	3.25E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	2.58E-04	2.52E-07
chloroform	1.52E-03	2.58E-04	3.93E-07
mercury	1.08E-04	2.58E-04	2.79E-08
tetrachloroethene	9.79E-04	2.58E-04	2.53E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	2.58E-04	2.52E-07
chloroform	1.52E-03	2.58E-04	3.93E-07
mercury	1.08E-04	2.58E-04	2.79E-08
tetrachloroethene	9.79E-04	2.58E-04	2.53E-07

Offsite Child Resident
Offiste Child Res. G. Water Dermal
Reasonable Maximum Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	2.21E-03	5.53E-05	1.22E-07
1,1,2,2-tetrachloroethane	1.01E-03	5.53E-05	5.61E-08
tetrachloroethene	1.01E-03	5.53E-05	5.61E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	1.02E-03	1.94E-04	1.97E-07
chloroform	2.21E-03	1.94E-04	4.28E-07
mercury	1.21E-04	1.94E-04	2.34E-08
tetrachloroethene	1.01E-03	1.94E-04	1.96E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	1.02E-03	1.94E-04	1.97E-07
chloroform	2.21E-03	1.94E-04	4.28E-07
mercury	1.21E-04	1.94E-04	2.34E-08
tetrachloroethene	1.01E-03	1.94E-04	1.96E-07

Offsite Child Resident
Offsite Child Res. Sediment Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	2.13E-10	1.30E-09
benzene	1.17E-01	2.13E-10	2.50E-11
hexachlorobenzene	5.67E+01	2.13E-10	1.21E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	1.66E-09	1.01E-08
hexachlorobenzene	5.67E+01	1.66E-09	9.42E-08
mercury	3.79E+01	1.66E-09	6.29E-08
chromium (VI)	3.27E+01	1.66E-09	5.42E-08

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	1.66E-09	1.01E-08
hexachlorobenzene	5.67E+01	1.66E-09	9.42E-08
mercury	3.79E+01	1.66E-09	6.29E-08
chromium (VI)	3.27E+01	1.66E-09	5.42E-08

Offsite Child Resident
Offsite Child Res. Sur. Water Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	5.42E-05	5.87E-06	3.18E-10
arsenic	2.83E-03	5.87E-06	1.66E-08

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	4.57E-05	1.29E-07
cadmium	1.19E-03	4.57E-05	5.44E-08
cyanide	1.50E-02	4.57E-05	6.83E-07
mercury	1.37E-03	4.57E-05	6.26E-08
nickel	1.33E-02	4.57E-05	6.06E-07
chromium (VI)	4.76E-03	4.57E-05	2.17E-07
zinc	1.31E-01	4.57E-05	6.00E-06

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	4.57E-05	1.29E-07
cadmium	1.19E-03	4.57E-05	5.44E-08
cyanide	1.50E-02	4.57E-05	6.83E-07
mercury	1.37E-03	4.57E-05	6.26E-08
nickel	1.33E-02	4.57E-05	6.06E-07
chromium (VI)	4.76E-03	4.57E-05	2.17E-07
zinc	1.31E-01	4.57E-05	6.00E-06

Offsite Child Resident
Offsite Child Res. Sur. Water Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	8.98E-05	1.96E-05	1.76E-09
arsenic	4.54E-03	1.96E-05	8.89E-08

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	6.85E-05	3.11E-07
cadmium	1.42E-03	6.85E-05	9.75E-08
cyanide	2.09E-02	6.85E-05	1.43E-06
mercury	1.78E-03	6.85E-05	1.22E-07
nickel	1.95E-02	6.85E-05	1.33E-06
chromium (VI)	6.35E-03	6.85E-05	4.35E-07
zinc	1.88E-01	6.85E-05	1.29E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	6.85E-05	3.11E-07
cadmium	1.42E-03	6.85E-05	9.75E-08
cyanide	2.09E-02	6.85E-05	1.43E-06
mercury	1.78E-03	6.85E-05	1.22E-07
nickel	1.95E-02	6.85E-05	1.33E-06
chromium (VI)	6.35E-03	6.85E-05	4.35E-07
zinc	1.88E-01	6.85E-05	1.29E-05

Offsite Child Resident
Offsite Child Res. Groundwater Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	1.52E-03	6.85E-03	1.04E-05
1,1,2,2-tetrachloroethane	9.79E-04	6.85E-03	6.71E-06
tetrachloroethene	9.79E-04	6.85E-03	6.71E-06

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	5.33E-02	5.20E-05
chloroform	1.52E-03	5.33E-02	8.10E-05
mercury	1.08E-04	5.33E-02	5.75E-06
tetrachloroethene	9.79E-04	5.33E-02	5.22E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	5.33E-02	5.20E-05
chloroform	1.52E-03	5.33E-02	8.10E-05
mercury	1.08E-04	5.33E-02	5.75E-06
tetrachloroethene	9.79E-04	5.33E-02	5.22E-05

Offsite Child Resident
Offsite Child Res. Sediment Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	5.87E-10	3.57E-09
benzene	1.17E-01	5.87E-10	6.89E-11
hexachlorobenzene	5.67E+01	5.87E-10	3.33E-08

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	4.57E-09	2.78E-08
hexachlorobenzene	5.67E+01	4.57E-09	2.59E-07
mercury	3.79E+01	4.57E-09	1.73E-07
chromium (VI)	3.27E+01	4.57E-09	1.49E-07

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	4.57E-09	2.78E-08
hexachlorobenzene	5.67E+01	4.57E-09	2.59E-07
mercury	3.79E+01	4.57E-09	1.73E-07
chromium (VI)	3.27E+01	4.57E-09	1.49E-07

Offsite Child Resident
Offsite Child Res. Sediment Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	3.91E-09	2.83E-08
benzene	2.21E-01	3.91E-09	8.65E-10
hexachlorobenzene	9.55E+01	3.91E-09	3.74E-07

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	1.37E-08	9.92E-08
hexachlorobenzene	9.55E+01	1.37E-08	1.31E-06
mercury	4.69E+01	1.37E-08	6.43E-07
chromium (VI)	3.75E+01	1.37E-08	5.13E-07

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	1.37E-08	9.92E-08
hexachlorobenzene	9.55E+01	1.37E-08	1.31E-06
mercury	4.69E+01	1.37E-08	6.43E-07
chromium (VI)	3.75E+01	1.37E-08	5.13E-07

Offsite Child Resident
Offsite Child Res. Fish/Game Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	4.04E-01	1.45E-05	5.87E-06
DDT	5.02E-01	1.45E-05	7.30E-06
DDD	1.82E+00	1.45E-05	2.64E-05
DDE	3.13E+00	1.45E-05	4.54E-05

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	4.04E-01	5.09E-05	2.06E-05
mercury	1.26E+00	5.09E-05	6.43E-05
DDT	5.02E-01	5.09E-05	2.56E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	4.04E-01	5.09E-05	2.06E-05
mercury	1.26E+00	5.09E-05	6.43E-05
DDT	5.02E-01	5.09E-05	2.56E-05

Offsite Child Resident
Offsite Child Res. Fish/Game Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	2.94E-01	6.25E-07	1.83E-07
DDT	3.92E-01	6.25E-07	2.45E-07
DDD	1.41E+00	6.25E-07	8.83E-07
DDE	2.52E+00	6.25E-07	1.57E-06

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	2.94E-01	4.86E-06	1.43E-06
mercury	1.03E+00	4.86E-06	5.01E-06
DDT	3.92E-01	4.86E-06	1.90E-06

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	2.94E-01	4.86E-06	1.43E-06
mercury	1.03E+00	4.86E-06	5.01E-06
DDT	3.92E-01	4.86E-06	1.90E-06

Offsite Adult Resident
Offsite Adult Resident Sur. Water Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	5.42E-05	9.37E-08	5.08E-12
arsenic	2.83E-03	9.37E-08	2.65E-10

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	7.29E-07	2.06E-09
cadmium	1.19E-03	7.29E-07	8.69E-10
cyanide	1.50E-02	7.29E-07	1.09E-08
mercury	1.37E-03	7.29E-07	9.99E-10
nickel	1.33E-02	7.29E-07	9.67E-09
chromium (VI)	4.76E-03	7.29E-07	3.47E-09
zinc	1.31E-01	7.29E-07	9.57E-08

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	7.29E-07	2.06E-09
cadmium	1.19E-03	7.29E-07	8.69E-10
cyanide	1.50E-02	7.29E-07	1.09E-08
mercury	1.37E-03	7.29E-07	9.99E-10
nickel	1.33E-02	7.29E-07	9.67E-09
chromium (VI)	4.76E-03	7.29E-07	3.47E-09
zinc	1.31E-01	7.29E-07	9.57E-08

Offsite Adult Resident
Offsite Adult Resident G. Water Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	1.52E-03	1.37E-05	2.08E-08
1,1,2,2-tetrachloroethane	9.79E-04	1.37E-05	1.34E-08
tetrachloroethene	9.79E-04	1.37E-05	1.34E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	1.06E-04	1.04E-07
chloroform	1.52E-03	1.06E-04	1.62E-07
mercury	1.08E-04	1.06E-04	1.15E-08
tetrachloroethene	9.79E-04	1.06E-04	1.04E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	1.06E-04	1.04E-07
chloroform	1.52E-03	1.06E-04	1.62E-07
mercury	1.08E-04	1.06E-04	1.15E-08
tetrachloroethene	9.79E-04	1.06E-04	1.04E-07

Offsite Adult Resident
Offsite Adult Resident G. Water Dermal
Reasonable Maximum Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	2.21E-03	9.11E-05	2.01E-07
1,1,2,2-tetrachloroethane	1.01E-03	9.11E-05	9.24E-08
tetrachloroethene	1.01E-03	9.11E-05	9.24E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	1.02E-03	2.13E-04	2.16E-07
chloroform	2.21E-03	2.13E-04	4.70E-07
mercury	1.21E-04	2.13E-04	2.57E-08
tetrachloroethene	1.01E-03	2.13E-04	2.16E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	1.02E-03	2.13E-04	2.16E-07
chloroform	2.21E-03	2.13E-04	4.70E-07
mercury	1.21E-04	2.13E-04	2.57E-08
tetrachloroethene	1.01E-03	2.13E-04	2.16E-07

Offsite Adult Resident
Offsite Adult Res. Sediment Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	8.79E-11	5.35E-10
benzene	1.17E-01	8.79E-11	1.03E-11
hexachlorobenzene	5.67E+01	8.79E-11	4.98E-09

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	6.83E-10	4.16E-09
hexachlorobenzene	5.67E+01	6.83E-10	3.88E-08
mercury	3.79E+01	6.83E-10	2.59E-08
chromium (VI)	3.27E+01	6.83E-10	2.23E-08

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	6.83E-10	4.16E-09
hexachlorobenzene	5.67E+01	6.83E-10	3.88E-08
mercury	3.79E+01	6.83E-10	2.59E-08
chromium (VI)	3.27E+01	6.83E-10	2.23E-08

Offsite Adult Resident
Offsite Adult Res. Sediment Dermal
Reasonable Maximum Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	4.69E-09	3.39E-08
benzene	2.21E-01	4.69E-09	1.04E-09
hexachlorobenzene	9.55E+01	4.69E-09	4.47E-07

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	1.09E-08	7.92E-08
hexachlorobenzene	9.55E+01	1.09E-08	1.04E-06
mercury	4.69E+01	1.09E-08	5.13E-07
chromium (VI)	3.75E+01	1.09E-08	4.10E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	1.09E-08	7.92E-08
hexachlorobenzene	9.55E+01	1.09E-08	1.04E-06
mercury	4.69E+01	1.09E-08	5.13E-07
chromium (VI)	3.75E+01	1.09E-08	4.10E-07

Offsite Adult Resident
Offsite Adult Res. Sur. Water Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	5.42E-05	1.51E-06	8.18E-11
arsenic	2.83E-03	1.51E-06	4.26E-09

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	1.17E-05	3.32E-08
cadmium	1.19E-03	1.17E-05	1.40E-08
cyanide	1.50E-02	1.17E-05	1.76E-07
mercury	1.37E-03	1.17E-05	1.61E-08
nickel	1.33E-02	1.17E-05	1.56E-07
chromium (VI)	4.76E-03	1.17E-05	5.59E-08
zinc	1.31E-01	1.17E-05	1.54E-06

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	1.17E-05	3.32E-08
cadmium	1.19E-03	1.17E-05	1.40E-08
cyanide	1.50E-02	1.17E-05	1.76E-07
mercury	1.37E-03	1.17E-05	1.61E-08
nickel	1.33E-02	1.17E-05	1.56E-07
chromium (VI)	4.76E-03	1.17E-05	5.59E-08
zinc	1.31E-01	1.17E-05	1.54E-06

Offsite Adult Resident
Offsite Adult Res. Sur. Water Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	8.98E-05	2.01E-05	1.81E-09
arsenic	4.54E-03	2.01E-05	9.14E-08

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	4.70E-05	2.13E-07
cadmium	1.42E-03	4.70E-05	6.69E-08
cyanide	2.09E-02	4.70E-05	9.83E-07
mercury	1.78E-03	4.70E-05	8.36E-08
nickel	1.95E-02	4.70E-05	9.15E-07
chromium (VI)	6.35E-03	4.70E-05	2.98E-07
zinc	1.88E-01	4.70E-05	8.85E-06

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	4.70E-05	2.13E-07
cadmium	1.42E-03	4.70E-05	6.69E-08
cyanide	2.09E-02	4.70E-05	9.83E-07
mercury	1.78E-03	4.70E-05	8.36E-08
nickel	1.95E-02	4.70E-05	9.15E-07
chromium (VI)	6.35E-03	4.70E-05	2.98E-07
zinc	1.88E-01	4.70E-05	8.85E-06

Offsite Adult Resident
Offsite Adult Res. Groundwater Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	1.52E-03	2.47E-03	3.75E-06
1,1,2,2-tetrachloroethane	9.79E-04	2.47E-03	2.41E-06
tetrachloroethene	9.79E-04	2.47E-03	2.41E-06

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-0[illegible]		87E-05
chloroform			[illegible]2E-05
mercury			7E-06
tetrachloroethene			8E-05

Appendix C

Hazard Index -- Ingestion -- Chr

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	9.76E-04	1.92E-02	1.87E-05
chloroform	1.52E-03	1.92E-02	2.92E-05
mercury	1.08E-04	1.92E-02	2.07E-06
tetrachloroethene	9.79E-04	1.92E-02	1.88E-05

Offsite Adult Resident
Offsite Adult Res. Groundwater Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chloroform	2.21E-03	1.17E-02	2.60E-05
1,1,2,2-tetrachloroethane	1.01E-03	1.17E-02	1.19E-05
tetrachloroethene	1.01E-03	1.17E-02	1.19E-05

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	1.02E-03	2.74E-02	2.78E-05
chloroform	2.21E-03	2.74E-02	6.06E-05
mercury	1.21E-04	2.74E-02	3.32E-06
tetrachloroethene	1.01E-03	2.74E-02	2.78E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
chlorobenzene	1.02E-03	2.74E-02	2.78E-05
chloroform	2.21E-03	2.74E-02	6.06E-05
mercury	1.21E-04	2.74E-02	3.32E-06
tetrachloroethene	1.01E-03	2.74E-02	2.78E-05

Offsite Adult Resident
Offsite Adult Res. Sediment Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	2.01E-09	1.46E-08
benzene	2.21E-01	2.01E-09	4.45E-10
hexachlorobenzene	9.55E+01	2.01E-09	1.92E-07

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	4.70E-09	3.40E-08
hexachlorobenzene	9.55E+01	4.70E-09	4.48E-07
mercury	4.69E+01	4.70E-09	2.20E-07
chromium (VI)	3.75E+01	4.70E-09	1.76E-07

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	4.70E-09	3.40E-08
hexachlorobenzene	9.55E+01	4.70E-09	4.48E-07
mercury	4.69E+01	4.70E-09	2.20E-07
chromium (VI)	3.75E+01	4.70E-09	1.76E-07

Offsite Adult Resident
Offsite Adult Res. Sediment Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	7.55E-11	4.59E-10
benzene	1.17E-01	7.55E-11	8.85E-12
hexachlorobenzene	5.67E+01	7.55E-11	4.28E-09

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	5.87E-10	3.57E-09
hexachlorobenzene	5.67E+01	5.87E-10	3.33E-08
mercury	3.79E+01	5.87E-10	2.22E-08
chromium (VI)	3.27E+01	5.87E-10	1.92E-08

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	5.87E-10	3.57E-09
hexachlorobenzene	5.67E+01	5.87E-10	3.33E-08
mercury	3.79E+01	5.87E-10	2.22E-08
chromium (VI)	3.27E+01	5.87E-10	1.92E-08

Offsite Adult Resident
Offsite Adult Res. Fish/Game Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	2.94E-01	6.24E-07	1.83E-07
DDT	3.92E-01	6.24E-07	2.45E-07
DDD	1.41E+00	6.24E-07	8.83E-07
DDE	2.52E+00	6.24E-07	1.57E-06

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	2.94E-01	4.86E-06	1.43E-06
mercury	1.03E+00	4.86E-06	5.01E-06
DDT	3.92E-01	4.86E-06	1.90E-06

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	2.94E-01	4.86E-06	1.43E-06
mercury	1.03E+00	4.86E-06	5.01E-06
DDT	3.92E-01	4.86E-06	1.90E-06

Offsite Adult Resident
Offsite Adult Res. Fish/Game Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	4.04E-01	2.18E-05	8.81E-06
DDT	5.02E-01	2.18E-05	1.10E-05
DDD	1.82E+00	2.18E-05	3.96E-05
DDE	3.13E+00	2.18E-05	6.82E-05

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	4.04E-01	5.09E-05	2.06E-05
mercury	1.26E+00	5.09E-05	6.43E-05
DDT	5.02E-01	5.09E-05	2.56E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
hexachlorobenzene	4.04E-01	5.09E-05	2.06E-05
mercury	1.26E+00	5.09E-05	6.43E-05
DDT	5.02E-01	5.09E-05	2.56E-05

Future Remedial Worker
Future Rem. Worker Sur. Water Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	5.42E-05	6.94E-07	3.76E-11
arsenic	2.83E-03	6.94E-07	1.96E-09

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	2.43E-05	6.86E-08
cadmium	1.19E-03	2.43E-05	2.90E-08
cyanide	1.50E-02	2.43E-05	3.63E-07
mercury	1.37E-03	2.43E-05	3.33E-08
nickel	1.33E-02	2.43E-05	3.22E-07
chromium (VI)	4.76E-03	2.43E-05	1.16E-07
zinc	1.31E-01	2.43E-05	3.19E-06

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	2.43E-05	6.86E-08
cadmium	1.19E-03	2.43E-05	2.90E-08
cyanide	1.50E-02	2.43E-05	3.63E-07
mercury	1.37E-03	2.43E-05	3.33E-08
nickel	1.33E-02	2.43E-05	3.22E-07
chromium (VI)	4.76E-03	2.43E-05	1.16E-07
zinc	1.31E-01	2.43E-05	3.19E-06

Future Remedial Worker
Future Rem. Worker Sur. Water Dermal
Reasonable Maximum Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	8.98E-05	5.55E-06	4.99E-10
arsenic	4.54E-03	5.55E-06	2.52E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	9.72E-05	4.41E-07
cadmium	1.42E-03	9.72E-05	1.38E-07
cyanide	2.09E-02	9.72E-05	2.04E-06
mercury	1.78E-03	9.72E-05	1.73E-07
nickel	1.95E-02	9.72E-05	1.89E-06
chromium (VI)	6.35E-03	9.72E-05	6.17E-07
zinc	1.88E-01	9.72E-05	1.83E-05

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/l)	Dermal Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	9.72E-05	4.41E-07
cadmium	1.42E-03	9.72E-05	1.38E-07
cyanide	2.09E-02	9.72E-05	2.04E-06
mercury	1.78E-03	9.72E-05	1.73E-07
nickel	1.95E-02	9.72E-05	1.89E-06
chromium (VI)	6.35E-03	9.72E-05	6.17E-07
zinc	1.88E-01	9.72E-05	1.83E-05

Future Remedial Worker
Future Remedial Work. Sediment Dermal
Average Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	3.25E-10	1.98E-09
benzene	1.17E-01	3.25E-10	3.82E-11
hexachlorobenzene	5.67E+01	3.25E-10	1.85E-08

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	1.14E-08	6.93E-08
hexachlorobenzene	5.67E+01	1.14E-08	6.46E-07
mercury	3.79E+01	1.14E-08	4.31E-07
chromium (VI)	3.27E+01	1.14E-08	3.72E-07

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	1.14E-08	6.93E-08
hexachlorobenzene	5.67E+01	1.14E-08	6.46E-07
mercury	3.79E+01	1.14E-08	4.31E-07
chromium (VI)	3.27E+01	1.14E-08	3.72E-07

Future Remedial Worker
Future Remedial Work. Sediment Dermal
Reasonable Maximum Exposure

Carcinogenic Risk -- Dermal

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	5.21E-09	3.77E-08
benzene	2.21E-01	5.21E-09	1.15E-09
hexachlorobenzene	9.55E+01	5.21E-09	4.97E-07

Hazard Index -- Dermal -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	9.11E-08	6.60E-07
hexachlorobenzene	9.55E+01	9.11E-08	8.70E-06
mercury	4.69E+01	9.11E-08	4.28E-06
chromium (VI)	3.75E+01	9.11E-08	3.41E-06

Hazard Index -- Dermal -- Chronic

Chemical	Chemical Concentration (mg/kg)	Dermal Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	9.11E-08	6.60E-07
hexachlorobenzene	9.55E+01	9.11E-08	8.70E-06
mercury	4.69E+01	9.11E-08	4.28E-06
chromium (VI)	3.75E+01	9.11E-08	3.41E-06

Future Remedial Worker
Future Rem. Worker Sur. Water Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	5.42E-05	1.40E-05	7.58E-10
arsenic	2.83E-03	1.40E-05	3.95E-08

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	4.89E-04	1.38E-06
cadmium	1.19E-03	4.89E-04	5.83E-07
cyanide	1.50E-02	4.89E-04	7.32E-06
mercury	1.37E-03	4.89E-04	6.70E-07
nickel	1.33E-02	4.89E-04	6.49E-06
chromium (VI)	4.76E-03	4.89E-04	2.33E-06
zinc	1.31E-01	4.89E-04	6.43E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	2.83E-03	4.89E-04	1.38E-06
cadmium	1.19E-03	4.89E-04	5.83E-07
cyanide	1.50E-02	4.89E-04	7.32E-06
mercury	1.37E-03	4.89E-04	6.70E-07
nickel	1.33E-02	4.89E-04	6.49E-06
chromium (VI)	4.76E-03	4.89E-04	2.33E-06
zinc	1.31E-01	4.89E-04	6.43E-05

Future Remedial Worker
Future Rem. Worker Sur. Water Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
alpha-BHC	8.98E-05	2.80E-05	2.51E-09
arsenic	4.54E-03	2.80E-05	1.27E-07

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	4.89E-04	2.22E-06
cadmium	1.42E-03	4.89E-04	6.97E-07
cyanide	2.09E-02	4.89E-04	1.02E-05
mercury	1.78E-03	4.89E-04	8.71E-07
nickel	1.95E-02	4.89E-04	9.53E-06
chromium (VI)	6.35E-03	4.89E-04	3.10E-06
zinc	1.88E-01	4.89E-04	9.22E-05

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/l)	Ingestion Intake Factor (l/kg/day)	Daily Intake (mg/kg/day)
arsenic	4.54E-03	4.89E-04	2.22E-06
cadmium	1.42E-03	4.89E-04	6.97E-07
cyanide	2.09E-02	4.89E-04	1.02E-05
mercury	1.78E-03	4.89E-04	8.71E-07
nickel	1.95E-02	4.89E-04	9.53E-06
chromium (VI)	6.35E-03	4.89E-04	3.10E-06
zinc	1.88E-01	4.89E-04	9.22E-05

Future Remedial Worker
Future Rem. Worker Sediment Ingestion
Average Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	6.99E-11	4.25E-10
benzene	1.17E-01	6.99E-11	8.20E-12
hexachlorobenzene	5.67E+01	6.99E-11	3.97E-09

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	2.45E-09	1.49E-08
hexachlorobenzene	5.67E+01	2.45E-09	1.39E-07
mercury	3.79E+01	2.45E-09	9.27E-08
chromium (VI)	3.27E+01	2.45E-09	7.99E-08

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	6.09E+00	2.45E-09	1.49E-08
hexachlorobenzene	5.67E+01	2.45E-09	1.39E-07
mercury	3.79E+01	2.45E-09	9.27E-08
chromium (VI)	3.27E+01	2.45E-09	7.99E-08

Future Remedial Worker
Future Rem. Worker Sediment Ingestion
Reasonable Maximum Exposure

Carcinogenic Risk -- Ingestion

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	5.59E-10	4.05E-09
benzene	2.21E-01	5.59E-10	1.24E-10
hexachlorobenzene	9.55E+01	5.59E-10	5.34E-08

Hazard Index -- Ingestion -- Subchronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	9.78E-09	7.09E-08
hexachlorobenzene	9.55E+01	9.78E-09	9.34E-07
mercury	4.69E+01	9.78E-09	4.59E-07
chromium (VI)	3.75E+01	9.78E-09	3.67E-07

Hazard Index -- Ingestion -- Chronic

Chemical	Chemical Concentration (mg/kg)	Ingestion Intake Factor (kg/kg/day)	Daily Intake (mg/kg/day)
arsenic	7.24E+00	9.78E-09	7.09E-08
hexachlorobenzene	9.55E+01	9.78E-09	9.34E-07
mercury	4.69E+01	9.78E-09	4.59E-07
chromium (VI)	3.75E+01	9.78E-09	3.67E-07